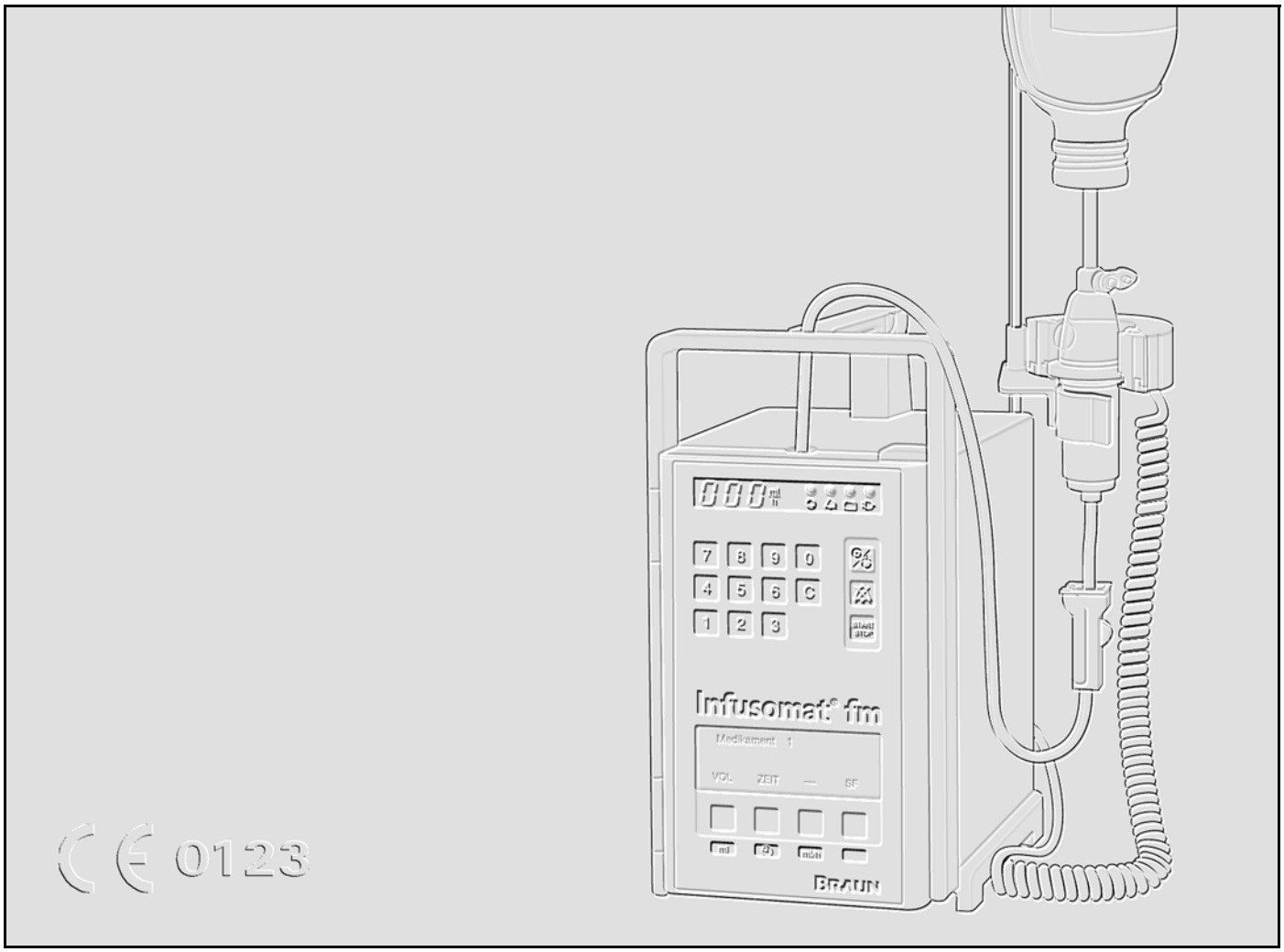
Infusomat® fm

Service Manual



Version 2.2 English

B BRAUN
SHARING EXPERTISE

This Service Manual is valid for

Voltages 200 V to 240 V:	Ord. No.
Infusomat® fm, German	871 9420
Infusomat® fm, French	871 9527
Infusomat® fm, Dutch	871 9535
Infusomat® fm, Italian	871 9560
Infusomat® fm, Danish	871 9438
Infusomat® fm, Norwegian	871 9497
Infusomat® fm, Swedish	871 9500
Infusomat® fm, Finnish	871 9519
Infusomat® fm, Spanish	871 9457
Infusomat® fm, Portuguese	871 9462
Infusomat® fm, English (BSI)	871 9446
Infusomat® fm, English	871 9543
Infusomat® fm, Turkish	871 9578
Infusomat® fm, Czech	871 9586
Infusomat® fm, Polish	871 9594

Voltages 100 V to 120 V:	
Infusomat® fm, English (BSI)	871 9411
Infusomat® fm, Dutch	871 9470
Infusomat® fm, Spanish	871 9489
Infusomat® fm, Castellano	871 9551

This Service Manual is available under the following part number:

Designation	Part No.
Service Manual Infusomat® fm, English	8713 9122

Languages of this Manual

Designation	Part No.
Service Manual Infusomat® fm, German	8713 9121

The complete Service Manual contains the following pages:

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Service Work

The present manual is for your information only. The possession of this manual does not authorize the performance of service work. Service tasks may only be executed by persons, who

- have received appropriate training on the system from B. Braun
- are included in the revision service
- possess the necessary test equipment and mechanical aids, and
- fulfill the personal requirements (training and knowledge).

Technical Safety Checks

The user is obliged to perform or to have performed the Technical Safety Checks on those medial products for which these checks have been prescribed by the manufacturer and to carry them out according to the indications of the manufacturer as well as the generally approved technical standards while adhering to the periods stated (§ 6 MP BetreibV).

B. Braun also recommends training on the Technical Safety Checks, or to perform at least the steps indicated in the current version of the manual, as:

- the TSC requires that the instructions in the manuals are observed
- the manuals are a reference for measurements
- depending on the unit type, the Service Program must be called which may lead to a dangerous unit condition in case of inappropriate operation. Furthermore, a special service connector may be necessary.

Current Versions

This manual version corresponds to the state when the manual was written. B Braun reserves the right to make technical modifications. The state of the revision is indicated by the index number in the footer of every page.

Revision Service

The possession of this manual does not automatically mean inclusion in the revision service. You will be included in the revision service after:

- technical training by B. Braun Melsungen or
- a written order placed with the sales department of B. Braun (fee required).

Responsibility of the Manufacturer

The manufacturer, person who assembles, installs or imports the device can only be held responsible for safety, reliability and performance if

- mounting, enhancements, new settings, changes or repairs are carried out by duly authorized persons,

- the electrical installation in the corresponding room meets the requirements of the VDE 0107, VDE 0100 part 710 or IEC 60364-7-710 and the national standards,
- the device is used in accordance with the instructions for use and the Service Manual,
- the Technical Safety Checks are performed at regular intervals,
- a current manual which corresponds to the revision state is used when carrying out maintenance, repair and service,
- the service technician takes part in the revision service,
- the technician has participated in a technical training course for the specific B. Braun unit.

Quality Management

B. Braun is certified in accordance with DIN EN ISO 9001 and ISO 13485. This certification also includes maintenance and service.

The unit has the CE label. The CE label confirms that the device corresponds to the "Directive of the Council for Medical Products 93/42/EC" of June 14, 1993.

Checks and Repair

Training may only be performed by B. Braun. The possession of the manual does not authorize the performance of repairs. The instructions on electrostatic sensitive components (ESD standards) must be observed.

After repair a device check or diagnosis is to be carried out.

Notes on ESD

Semiconductors can be destroyed by electrostatic discharge. Especially MOS components can be damaged by interference from electrostatic fields, even without discharge via contact. This type of damage is not immediately recognizable. Unit malfunctions can even occur after a longer period of operation.

Each workstation must be equipped according to the recommendations with the necessary static protective measures, if ESD components or boards are handled.

Each workstation must be equipped with a conductive table surface. The conductive surface, the soldering iron or the soldering stations must be grounded via protective resistors.

Chairs must be of antistatic design. The floor or floor mats should be of electrically conductive material.

Personnel must wear conductive wristbands which are connected to a central ground potential via protective resistors, e.g. the ground contact of a wall outlet. Furthermore it is recommended that personnel wear cotton clothing and electrically conductive shoes to prevent electrostatic charge.

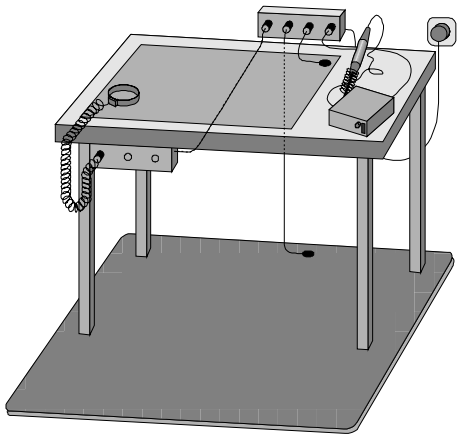

Fig.: 0 - 1

Spare Parts and Test Equipment

Only use original spare parts from the manufacturer. Do not tamper with assembly groups which can only be exchanged completely. The spare parts required are listed in Section 9.

Service personnel are responsible for the calibration of their test equipment. Original test equipment can be calibrated at the works of B. Braun. Further information is available upon request.

Setting Off

Additional notes and warnings are set off as follows:

Note

Is used for additional or special notes concerning information and working steps.

CAUTION

Is used for working steps which may result in damage to the unit, system or to a connected device.

WARNING

IS USED FOR WORKING STEPS WHICH MAY RESULT IN PERSONAL INJURY.

References to chapters are shown as follows
(see "Setting Off" ➨ pg. 0 - 8)

References to figures and tables are shown as follows
Fig.: 2 - 3 or Table 2 - 1

References to item numbers in figures are shown as follows
(Fig.: 1 - 1 / Item 1)
In this case "Fig.: 1 – 1" is the figure number and "Item 1" the item number within the figure.

When the Service Manual is stored as pdf-file, these references are displayed green. Click with the mouse button on a reference to jump to the corresponding source.

Menu commands are described as:
Menu *File*.

List of Abbreviations

Abbreviations which are not generally known, but are used in this manual, are listed below.

CC	Computer Controlled
CLR	Clear
Dig	Digit
ESD	Electrostatic Discharge
UA	Unit Alarm
FuP	Function Microprocessor
KuP	Control Microprocessor
LCD	Liquid Crystal Display
OIL	Original Infusomat Line
PCA	Patient Controlled Analgesia
TSC	Technical Safety Check
TEMP	Temperature

Contact Persons 0

Technical Training	Via local representative.
Entry for Technical Training	Application for a technical training course must be made via the responsible representative.
Ordering of Spare Parts and Test Equipment	Please contact your local B. Braun subsidary.
	International Technicians (Intercompany) Nadja Machal Fax: +49 5661 / 75 -47 89 e-mail: nadja.machal@bbraun.com
Service Hotline	Karl Tippel, Tanja Kördel Phone: +49 5661 / 71 - 35 25 Fax: +49 5661 / 71 - 35 26 e-mail: karl.tippel@bbraun.com e-mail: tanja.koerdel@bbraun.com
Return of Spare Parts and Test Equipment	B. Braun Melsungen AG Schwarzenberger Weg 73-79 Wareneingang Werk C 34 212 Melsungen Germany
Safety Officer (§ 30 MPG)	Dr. Ludwig Schütz e-mail: ludwig.schuetz@bbraun.com
Translation	PAS GmbH, Brückner GmbH, Germany

0 Contact Persons

For your notes:

System Overview 1

Physical Construction

The Infusomat fm is a compact volumetric peristaltic infusion pump.

Standard delivery rate range 1 to 999 ml/h

The unit is operated via a membrane keyboard. It is equipped with an LED display (light emitting diode display) for delivery rate display and an LCD display (liquid crystal display) for the operating support of the user. Four control LEDs display alarms, battery- and mains operation and the running of the infusion pump.

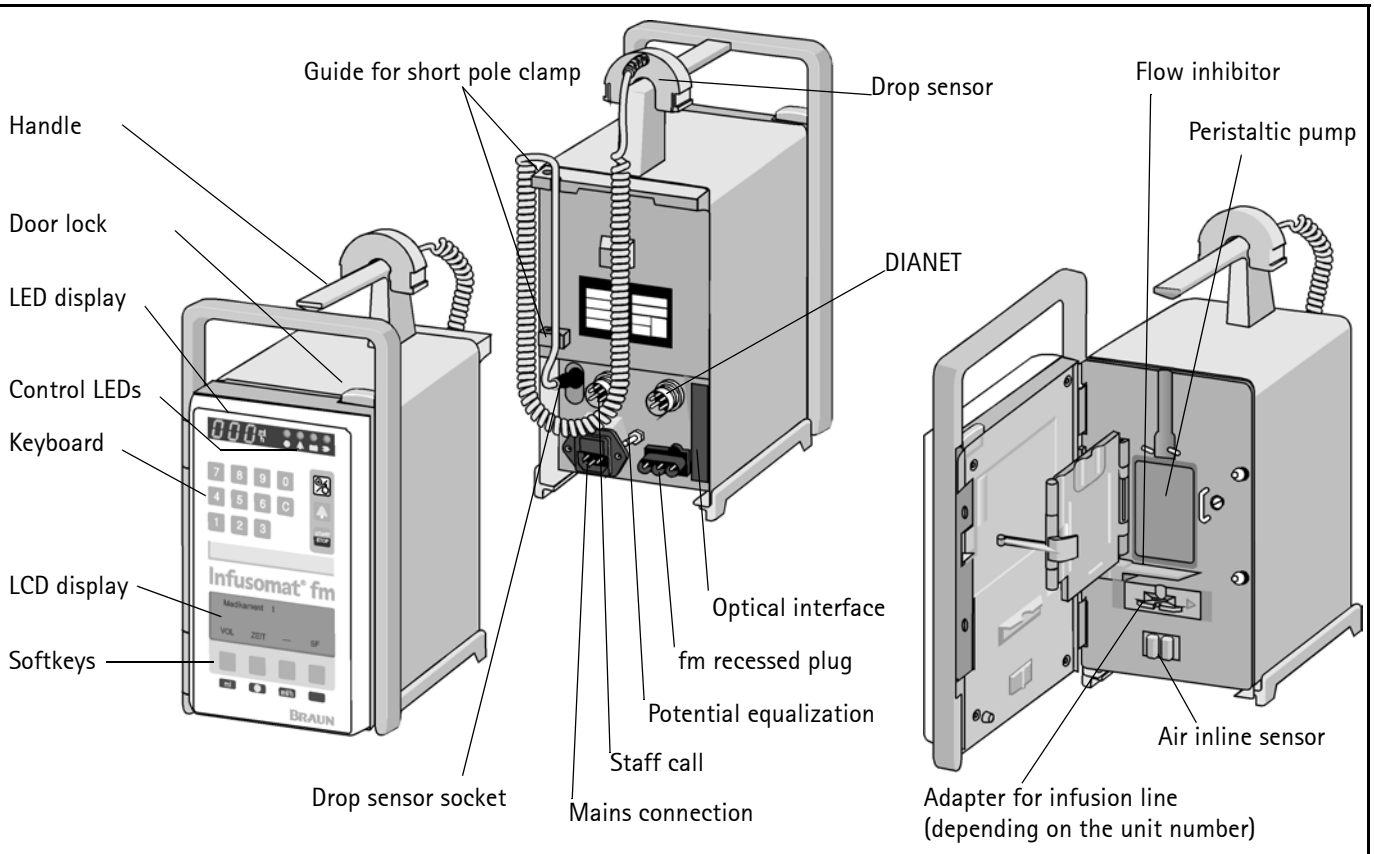

Fig.: 1 - 1 Unit overview Infusomat fm from unit 000001 on

1 System Overview

Operation Flow Chart

[1] See Service Program diagram

[2] Only when preselected time or preselected volume has expired

[3] Please pay attention to activation in Service Program

Fig.: 1 - 2

See instructions for use for detailed information.

Function

Two independent software-controlled microprocessor systems control and monitor the hardware. On the basis of their functions, they are defined respectively as a control and a function processor. Both systems work with independent clock frequencies and have access to different program and data memories. All safety-relevant functions are handled by both microprocessors and the results are counter checked (CF- and FC-latch).

The input via the keyboard is fed to both processors. Additionally the acknowledgement signal of the ON/OFF key is fed to the mains power supply logic (voltage E/A-TAS). The function processor has also access to this logic via E/A-INT.

Description of the voltage signals (see „Signal table“ ➪ p. 1 - 5).

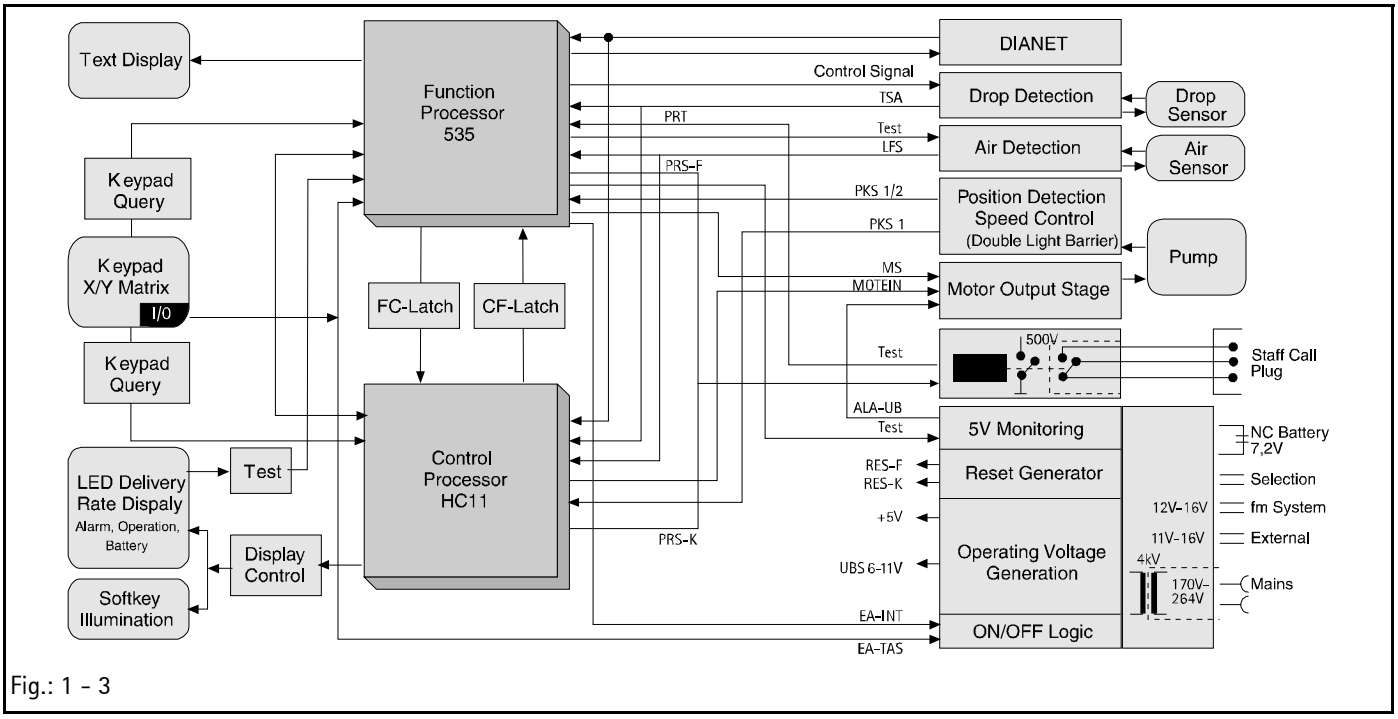

Fig.: 1 - 3

Voltage Supply

The voltage supply can be generated directly from mains (170V to 264V~ or 85V to 132V~), an external 12 V supply connected to a fluid manager system or the DIANET recessed plug or as an internal supply via the internal 7.2 V NiCd battery. The battery type (long- or short time battery) is identified by the coded battery plug.

A voltage of 12V to 32V is available after transformation and rectification. The voltage regulator limits voltage to max. 12V. This voltage is fed to the battery charge circuit and the unit supply via isolation diodes. This is also valid for an external 12V voltage from the DIANET or an fm plug. The FET V22 switches between external and internal voltage supply. The transistor V29 works as an ON/OFF switch for the operating voltages UPS, UMOT and +5V. The +5V supplies the complete electronics including the double channel microprocessor system. A window comparator constantly monitors the +5V for undervoltage or overvoltage. The function is checked during switch-on. The operating voltage UPS supplies the stepper motor and UMOT the stepper motor drive.

The transistor V21 switches the operating voltage UMOT. In case of an alarm the motor is switched off by V21. Additionally the switching function of the transistor is checked during the switch-on test.

The circuit has two separate assembly groups with separate supply voltages UBA and UBB. The ON/OFF circuit UBA is a retriggerable delay switch-off. A follow-up charging circuit drives the transistor V29. V18 is additionally active in battery operation.

The alarm logic UBB is an RS latch. This is set when the unit is running and activates the alarm circuit. The alarm buzzer and driver are also driven by UBB.

The ON/OFF circuit is activated and the voltage supply is switched on by pressing the ON/OFF key. The alarm latch is reset simultaneously. A function test of the voltage monitoring, motor circuit and alarm activation is performed. The voltage supply is maintained by cyclic self-holding pulses fed to the logic. The alarm latch is also activated.

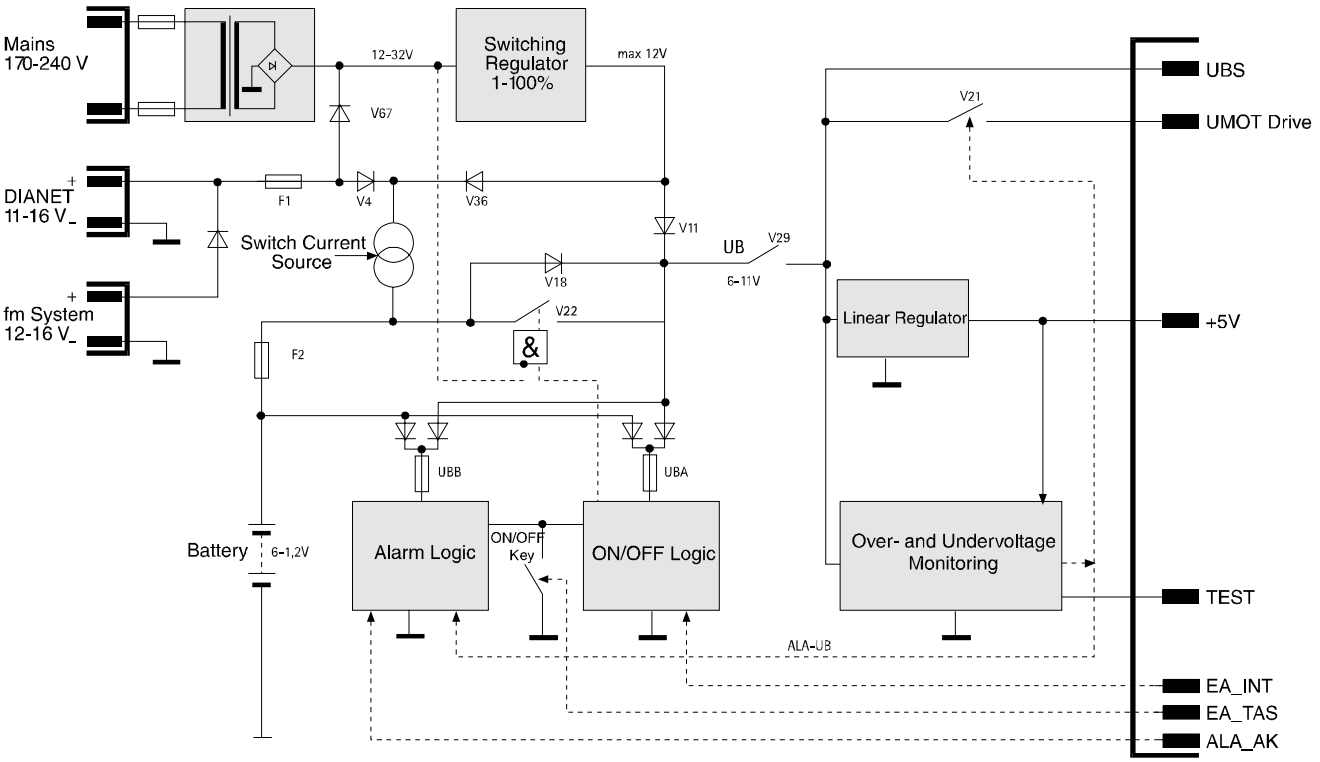

Fig.: 1 - 4

Signal table

Signal	Meaning	Signal	Meaning
+5V	Voltage supply electronic	PRS-K	Staff call relay control channel
5V-HT	Overvoltage test	PRT	Staff call relay test
5V-LT	Undervoltage test	RDCL	Delivery display clock
AK-I	Battery charge and discharge current	RDD	Delivery display data
AK-LAD	Battery capacity ON/OFF	RDE	Delivery display enable
AK-Test	Battery test	RDTA	Delivery display test output
ALA-RED	Alarm reduction	RDTS	Delivery display test synchronization
ALA-UB	Operating voltage alarm	RES	Power on Reset
CS	Chip Select	RES-F	Reset function channel
DI	Data Input	RES-K	Reset control channel
DO	Data Output	RTS	Return to send (DIANET)
E/A-INT	ON/OFF by microprocessor	Rx	Receive data
E/A-ST	ON/OFF status	SA1	Tube adapter 1

Table 1 - 1 Signal table (Part 1 of 2)

Signal	Meaning	Signal	Meaning
E/A-TAS	ON/OFF key	SA2	Tube adapter 2
EDB	Electronic pressure control	SCK	Serial data lock
EXTN	External 12V supply (-)	SL-S	Tube adapter OIL
EXTP	External 12V supply (+)	TD-A0	Text Display Address 0
EXTPP	External 12V supply (FM)	TD-A1	Text Display Address 1
FL-S	Tube adapter OIL-FM	TD-A2	Text Display Address 2
LFCL	Air sensor clock	TD-A3	Text Display Address 3
LFDA	Air sensor data	TD-B	Text display illumination
LFS	Air sensor signal	TD-E	Text Display Enable
LFSEL	Air sensor selection	TD-KL	Text display contrast latch
LFT	Air sensor reset	TD-R/W	Text Display Read/Write
MISO	Serial data output interface	TD4	Text Display Data 4
MOSI	Serial data input interface	TD5	Text Display Data 5
MOTEIN	Motor ON	TD6	Text Display Data 6
MS	Motor control	TD7	Text Display Data 7
NA	Mains display	TSA	Drop sensor output
P-ENA	Port Enable	TSCL	Drop sensor clock
PA	Potential equalization	TSE	Drop sensor receiver
PH0	Phase 0	TSR	Drop sensor regulation
PH1	Phase 1	TSS	Drop sensor control
PH2	Phase 2	Tx	Transmit data
PH3	Phase 3	UB	Operating voltage 6-12V
PKS	Pump cover sensor	UBA	Supply voltage for alarm, On/Off logic, RTC
PKS1	Pump head sensor 1	UPS	Switched operating voltage UB
PKS2	Pump head sensor 2	UPS-M	UPS measuring line
PKSS	Pump head sensor control	UMOT	Supply voltage of motor drive
PRS	Staff call relay control	UMOT-M	UMOT measuring line
PRS-F	Staff call relay function channel	URTC	Supply voltage clock module

Table 1 - 1 Signal table (Part 2 of 2)

Mains Operation

When the unit is connected to mains the unit supply voltage is switched on for the duration of the switch-off delay time. If the microprocessor recognizes a sufficient mains voltage for charging, the voltage supply is maintained. In this case only a battery balance is carried out, because a key was not pressed. The mains control LED is switched on, all other displays are off.

The unit is switched off when the ON/OFF key is pressed for at least 2 seconds. Thereby the self-holding is triggered and the alarm latch is reset with a delay. After another 8 seconds the unit is switched off, because the pulses are missing. If the Infusomat fm is switched off in mains operation with the ON/OFF key, the internal mains voltage is still present. All displays are switched off and battery charging is monitored.

In mains operation battery function is checked during the switch-on test. Therefor the charge- and discharge current are measured and battery charging is interrupted for the duration of measurement.

Battery Operation

The battery function is monitored by the following data: charge current, discharge current and time, and self-discharge time. The electronic detects a short time or a long time battery by measuring the charge current.

In battery operation the battery function is checked during switch-on test. The theoretical load condition is read from the clock module of the battery. Then the battery is connected to UPS and the voltage is measured. If the minimum requirements are not reached a battery alarm is activated.

Alarm Circuit

The control microprocessor drives the red alarm LED.

A function check is performed during the switch-on test.

The alarm buzzer is activated in case of:

- an operating alarm from control processor (ALA-AK signal)
- a unit alarm from both processors

Alarm generation:

The user checks this function during the switch-on test. The audible alarm volume in double stage operation is approx. 50 dBA. If no alarm acknowledgement or unit handling is performed, the maximum volume (approx. 65 dBA) is activated after 2 minutes.

A single or double stage alarm can be selected in the Service Program. The volume is immediately 65 dBA in single stage mode.

The staff call is activated by the processor system (PRS signal). A function check is performed with a second relay contact (PRT signal). A static or dynamic staff call can be selected.

Pump Unit

The pump head is driven by a stepper motor. Each full step of the motor is realized with 5 microsteps. The motor is driven by an FET output stage. The function processor controls the motor via the MS signal. A slot disc which is mounted on the pump head axle is scanned by two light barriers (PKS1 and PKS2 signal). Thereby the control microprocessor monitors direction of rotation and speed of the pump head.

The pump head position is also determined with the PKS2 signal. The motor can therefore be accelerated during the withdrawal phase. Thus a nearly pluse-free flow is realized in the lower delivery range (<100 ml/h). The total pump head cycles and running time are available in the Service Program under history data.

Mechanical Pressure Control:

The Infusomat fm has a linear peristaltic pump. This pump has 12 slides which are driven by a camshaft.

When the pump cover is closed, the pump tube is squeezed (occlusion) by at least one of the slides, independent of the pump head position. The complete pump unit is mounted behind the front panel in the frame. Hinges and locking bow for the pump cover are led through the front panel. The pump cover is automatically closed when the operating unit door is closed. The slides are pressed against the pump cover by a spring system in the pump unit. Thereby a delivery pressure is realized and mechanically limited by the springs.

If the pressure limit is exceeded there is no volume delivery. The drop sensor activates an alarm. If one of the springs fails, the spring system will ensure that an unsafe condition cannot occur (free flow). The two remaining springs ensure an appropriately high occlusion pressure.

Electronic Pressure Control:

The electronic pressure sensor is mounted on the output side of the pump. A spring pressure loaded slide is seated on the infusion line. An increase of pressure in the infusion line leads to a deflection of the coil core via the pressure slide. The depth of immersion is measured inductively. When a preset pressure threshold is reached the pump drive is switched off, and an alarm is activated. The electronic pressure control is a single channel circuit. In case of a failure, the mechanically limited maximum pressure can be reached.

Motor Switch-Off by Both Processors:

Function processor: MS signal to switch off the motor drive. - Control processor: MOTEIN signal to switch off the drive of the motor operating voltage.

Computer Interface

The DIANET is designed as a 5V TTL interface until unit No. 17147. From unit No. 17148 on an RS 232 interface is present. Retrofitting is possible by exchanging the rear panel (see „Rear Panel Board“ ➪ p. 4 - 11). The RS 232 interface is marked by a label on the rear side of the Infusomat fm.

Only the following accessories must be applied for the ohmic insulation between the Infusomat fm and a PC.

Designation	Ord. No.
For the 5V TTL interface. . . . . Interface converter DIANET sc	0871 9322
Interface line . . . . . Infucab fm, for RS232 interface	0871 1640
Interface cable fm without ohmic insulation . . . . . (Only applicable for servicing without unit connected to a patient.)	0871 1658

1 System Overview

Braun fluid manager system (fm system)

The Infusomat fm can be operated as a stand-alone unit or integrated in an intensive care unit, e.g. the B. Braun fluid manager system. It is integrated by simply snapping the unit into the system.

Mains supply and data communication are automatically connected. Thereby data acquisition and transmission to higher computer system levels are possible.

Internal Assignment

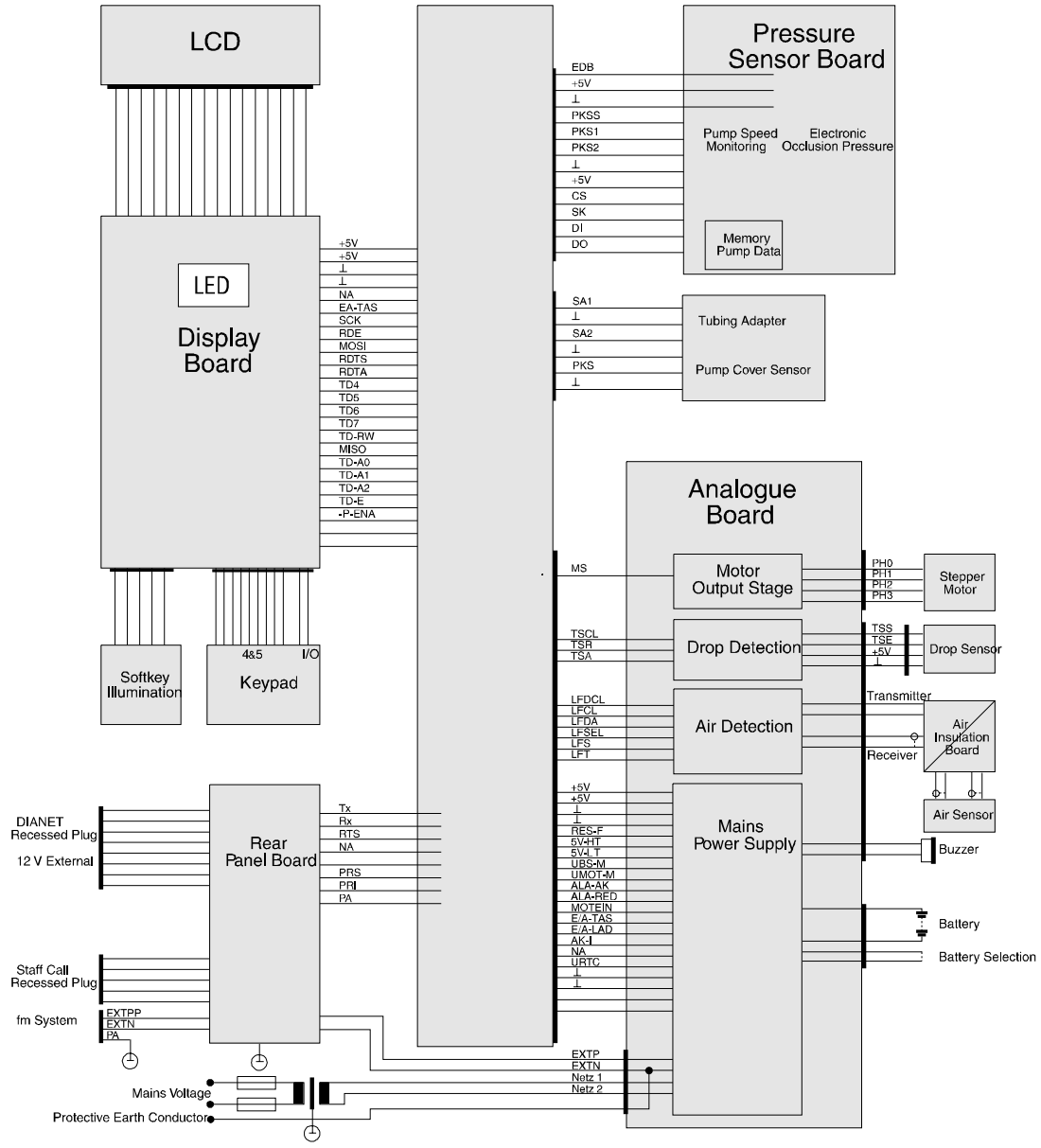

Fig.: 1 - 5

Accessories

General

Designation	Ord. No.
Mounting clip for drop chamber "TK 2000"	3477 3223
Mounting clip for drop chamber "Intrafix air"	3477 3215
Drop sensor, complete	3450 578A
Short stand	0870 1644
Drop chamber holder	3477 3088
Mains lead (200-240V~)	3450 2718
Mains lead (100-120V~)	3450 5423
Holder for mains plug (option)	3450 5474
Universal clamp, complete	3450 5857
Pole clamp (universal clamp, rotating)	3450 9054

For your notes:

Software 2

Software Update

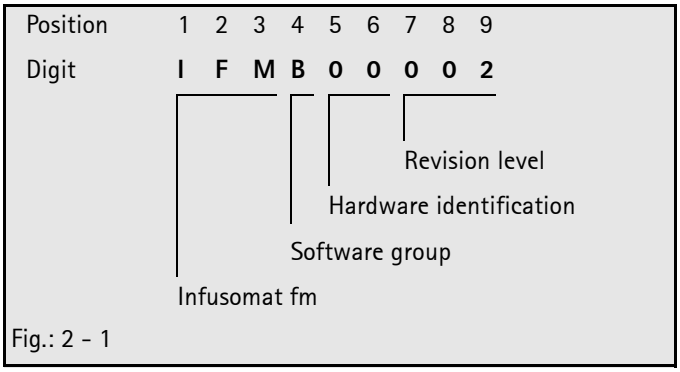

Fig.: 2 - 1

Designation **Ord. No.**

Update kit IFMB00002 or IFMB01002 . . . . . 3450 6306

The higher digit always replaces the lower digit for the revision level, e.g. IFMA00003 replaces IFMA00002.

Units with an old software version, e.g. IFMA00003 can be updated to the new software version IFMB00002.

When the software group changes (IFMA00002) the unit functions are changed, too. Therefore unit users must be informed (e.g. instruct the user and exchange the instructions for use – software coding, e.g. IFMB00002 is on the cover page of the instructions for use.)

Note

Mark the unit after having updated the software! The new software version must be clearly recognizable.

Only update from old to new software versions, never in reverse order (e.g. never update from IFMB00002 to IFMB00001 or IFMA00003!).

All units used in one ward should have the same software status and basic setup to avoid operator mistakes.

Note

Software updates must be reported to B. Braun for registration. Observe the notes of the update program and the supplements.

Approved Software Versions

IFMA00002

- Basic software

IFMA00003

- Improved resistance to interference against electrostatic charges.
- The opto staff call is corrected after switch-off.
- Extended display of unit alarms. The unit alarm no. is displayed on the LCD display.

IFMA00003 (17.05.95)

Elimination of unit alarms (modification of the hc-11 software):

- For frequent starts and KOR (KVO) operations.
- For switch-on with empty battery.

IFMB00001 or IFMB01001

Expanded functions:

- Optimization of staff call modes
  (see instructions for use – staff call lines).
- Extension of the interface functions for recommended data (see DIANET interface description).
- Display of battery capacity, ward identification and software version when the unit is switched off.
- Activation of the display light in battery operation when a key is pressed.
- Decimal function (can be activated in Service Program). Preselect delivery rate from 1 to 99.9 ml/h with increments of 0.1 ml/h.
- Display of the calculated rate from volume and time with one decimal. Thus the rounding error is significantly reduced.
- Additional running control on the LCD.
- Additional alarm display.
  Delivery display flashes with RATE and AAA.
- Correction of the total air alarm (accumulation of microbubbles) from 0.7ml to 1.5 ml air per hour.
- 10 minutes alarm tone suppression (can be activated in the Service Program).
- Special functions can be deactivated in the Service Program.
- Service Program menu point Calibration Pump Head (code 500) is replaced by Calibration Pressure Sensor (code 500) and Calibration Scale Factor (code 510).
- Service Program menu point Air Inline Sensor (code 300) now includes only the display of the measured values and the test values.
- Stored operating alarms can be deleted in the Service Program.

Software IFMB00002 or IFMB01002

Expanded Functions

- The min./max. delivery rate can be set.
- The air rate alarm can be set between 0.5 ml/h and 3.5 ml/h.
- Display of the operating hour counter in the SM battery capacity

Error Elimination

- Opto staff call

Error Messages and Alarms

WARNING

NEVER OPERATE THE UNIT WITH PLUGGED IN SERVICE CONNECTOR ON THE PATIENT. WHEN THE UNIT WAS OPERATED WITH PLUGGED IN SERVICE CONNECTOR IT IS TO BE SWITCHED OFF ONCE BEFORE ANY FURTHER USE.

Alarms of the function processor 80c535 are displayed on the LCD display. Alarms of the control processor 68hc11 are displayed on the LED display. The alarms help to troubleshoot unit malfunctions. As not all malfunctions can be considered, unit malfunctions with different messages or even no messages can be displayed on the LCD/LED display.

Software IFMA00002, IFMA00003:

Detected unit alarms are displayed as
"!! Unit Defective !!" on the LCD display in the selected language. If the unit LED has malfunctions "LED Test Error !" will be displayed. Additionally the error number (from IFMA0003 on, for IFMA00002 the number is not displayed) is displayed on the LCD display if the service connector is not plugged in. If the service connector is plugged in, a German text is displayed instead of the alarm number.

1. LCD display function processor 80c535:

Code	Text*	Description
--	???	alarm reason not clear
01	externes RAM defekt	defective external RAM 8k x 8
02	T1_Netzteiltest	power supply test: 5V_HT=0; 5V_LT=1; MOTEIN=1: UMOT-M unequal 1
03	T2_Ueberspannungtest	power supply test: 5V_HT=1; 5V_LT=1; MOTEIN=1: UMOT-M unequal 0
04	T3_Motorabschalttest	power supply test: 5V_HT=0; 5V_LT=1; MOTEIN=0: UMOT-M unequal 0
05	T4_Unterspannungstest	power supply test: 5V_HT=0; 5V_LT=0; MOTEIN=1: UMOT-M unequal 0!
06	EA_Taste_klemmt	ON/OFF key was pressed longer than 14 sec
07	Luftfalle defekt	defective air sensor (calibration value?)
08	LED Test Fehler !	defective LED display
09	LED Test Fehler !	defective LED display
0A	LED Test Fehler !	defective LED display
0B	LED Test Fehler !	defective LED display
0C	LED Test Fehler !	defective LED display
0D	LED Test Fehler !	defective LED display

Table 2 - 1 (Part 1 of 2)

Code	Text*	Description
0E	LED Test Fehler !	defective LED display
0F	535 ROM defekt	defective program
10	Modulzeitkon. XX	defective program flow
11	MS hat Frequenz	MS has frequency without drive
12	pku Erfassung 535 !	pump head cycle not plausible
13	Tastatur defekt	different keypad gaps between 80c535 and 68hc11
14	Mode unterschiedlich	mode in 68hc11 different from 80c535
15	Mode geaendert	changed operating mode
16	Schlauchadapter fehlt	defective tube adapter
17	Version ungleich	different program versions between 68hc11 and 80c535
18	c535 Timeout XX	defective program flow
19	testbit_defekt	testbit=enable out of switch-on limits
1A	personalruf_defekt1	535 active PR, hc11 not active PR: PR=active
1B	personalruf_defekt2	535 not active PR, hc11 active PR: PR=active
1C	personalruf_defekt3	535 not active PR, hc11 not active PR: PR=not active

Table 2 - 1 (Part 2 of 2)

* Text will be only displayed if the service connector is plugged in.

2. LED display control processor 68hc11:

   Fxx/Exx flashes alternately on the LED display. Fxx is the error code. Exx can be neglected. If errors occur simultaneously, the alarms are displayed by hexadecimal addition, e.g. defective battery F01 and defective time F10 = error code F11.

Code	Description
F01	defective battery
F02	defective pump head
F04	defective ROM memory
F08	defective EEPROM memory
F10	defective time
F20	defective active
F40	defective active reset
F80	defective switch

Table 2 - 2

Software IFMB000XX

Detected alarms are displayed on the LCD display as "Unit Alarms" in the selected language. If the unit LED display has malfunctions "LED Test Error !" will be displayed. Additionally the error number is displayed on the LCD display.

1. LCD display function processor 80c535:

Code	Text*	Description
100		defective RAM memory U13
101		UMOT cannot be switched on
102		UMOT still switched on despite overvoltage
103		UMOT still switched on despite MOTEIN=0
104		UMOT still switched on despite undervoltage
105		ON/OFF key pressed longer than 14 sec
106		defective air sensor (calibration value ?)
107		defective LED display
108		defective LED display
109		defective LED display
110		defective LED display - RDTS
111		defective LED display
112		defective LED display
113		defective LED display
114		defective program memory U10, U11, U15
115		defective program flow
116		MS has frequency without drive
117		different number of pump head cycles
118		different keypad gaps between 80c535 and 68hc11
119		mode different in 68hc11
120		changed operating mode
121		defective tube adapter
122		different program versions between 68hc11 and 80c535
123		defective local program flow
124		testbit=0 out of switch-on test
125		PR is not active though 80c535 active PR and 68hc11 active PR
126		PR is active though 80c535 not active PR and 68hc11 active PR
127		text not loaded / defective program memory U10, U11, U15
128		text does not match with program / defective program memory U10, U11, U15

Table 2 - 3

* Text will be only displayed if the service connector is plugged in.

2. LED display control processor 68hc11:

   Fxx is displayed on the LED display with flashing dots. Fxx is the error code.

Code	Description
F01	dummy for test
F02	battery not present / missing battery current
F03	defective RAM memory U17
F04	defective program memory U21, U22, U31
F05	defective program memory U21, U22, U31
F06	calibration data error from EEPROM U1
F07	pump head cycle not plausible
F08	failure / inaccuracy of system clock
F09	failure 100msec system clock
F10	reset during active operation
F11	changed mode or 80hc535 different
F12	no dynamic pressure sensor signal (EDB)
F13	different status during start

Table 2 - 4

Alarm Causes

1. Drop alarm/pressure alarm
   - Empty infusion bottle?
     Connect new bottle.
   - Closed roller clamp/flow?
     Close roller clamp, stop infusion, open roller clamp. There must be no continuous dripping. If necessary insert new infusion line.
   - Occlusion?
     Lay line without any kinks and check integrity of complete infusion line.
   - Drop chamber clouded?
     Shake to remove. Drop sensor not inserted/connected? Insert/connect drop sensor.
   - Defective drop sensor?
     If necessary exchange drop sensor.
2. Air alarm
   - Air in system?
     Insert line correctly. Vent and reset fluid level in the drop chamber.
3. Standby alarm
   - Alarm after set PAUSE has expired?
     Switch to standby with SM, stop PAUSE with OFF or extend PAUSE with ON.
4. Battery alarm
   - Battery alarm or battery prealarm?
     Switch off immediately, connect to mains or to 12V. Charge battery.
5. KOR alarm
   - Preselect new delivery rate and start again.
6. Further alarms/displays
   - Pump cover open?
     Close door, set rate.
   - No rate?
     Enter new value. Value correction?

2 Software

Software Default Values **Unit No.:** _____

	Menu Item	Default	Customer Setting
Standard function	User language	depending on Art. No.	_____
	Alarm type	double-stage	_____
	Staff call	static without OFF alarm	_____
	Ward identification	"Ward Identification"	_____
	Drug 0	blank	_____
	Drug 1 ... 9	drug 1 ... 9	_____
	Operating alarms	0	_____
	Minimum delivery rate**	1.0 ml/h	_____
	Maximum delivery rate**	999.0 ml/h	_____
	Maximum air rate**	1.5 ml/h	_____
	Maximum bubble size**	0.3 ml	_____
Special Functions*	Standby	activated	_____
	Drug selection	activated	_____
	CC mode	activated	_____
	Switch-off pressure	activated	_____
	Drop control	activated	_____
	Battery capacity	activated	_____
	Data lock	activated	_____
	Contrast	activated	_____
	Decimal function*	deactivated	_____
User Data	Switch-off pressure	high	_____
	Contrast	optimum contrast	_____
	CC address	1	_____
	Drug	0	_____
	Data lock	Off	_____
	Standby time	30 min	_____
	Drop control	On	_____
Calibration Data	Air inline sensor calibration value	182mV	must not be changed
	Scale factor OIL	54	_____
Unit Specific Data	Contrast only if necessary	set to maximum without overmodulation	
	DIANET type no.	depending on unit	_____
	Unit No.	depending on unit	_____
	Operating hours	depending on unit	_____
	Battery hours	depending on unit	_____
	Number of pump head cycles	depending on unit	_____

* only from software IFMB01001 or IFMB0001 on

** from software IFMB00002, IFMB01002 on

For your notes:

Service Program 3

Structure of the Service Program

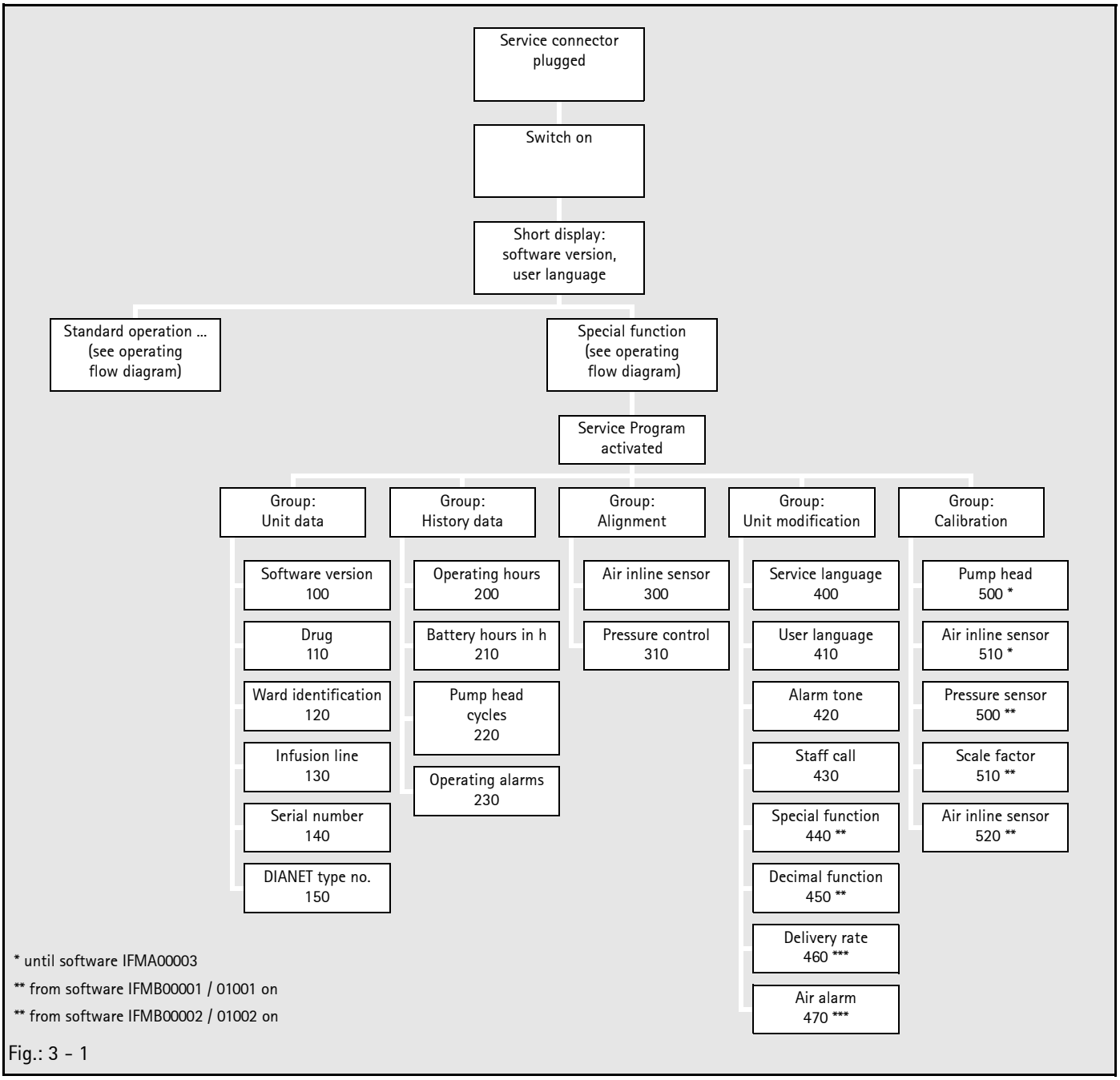

Fig.: 3 - 1

Additional Functions with Plugged in Service Connector

WARNING

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Software Version and User Language

1. Plug service connector on staff call socket at the rear of the unit.
2. Switch on unit and keep the ON/OFF button pressed (for max. 15 s).
3. The software version, date, and user language are displayed in the LCD display.
4. The unit is switched on when the ON/OFF button is released.
5. ** appears in the LCD display if the service connector is plugged.

The following conditions are activated:

- Operating alarms are muted.
- All special functions are accessible (including the disabled ones).
- Special functions are slightly modified. (Example: SM battery capacity has keys for 0 min/5 min).

Contrast Setting

1. Select "Contrast Setting" with SM key. The softkey symbols "clock" and "ml/h" are flashing.
2. Set display contrast with the (+) or (-) key.
3. Return to main menu with END.

Mechanical Pressure Control

Switch off the electronic pressure monitoring to check the mechanical pressure control.

1. Select "Switch-off pressure" with SM key.
2. Then select "mechanical".
3. Return to main menu with END.

Start / Quit the Service Program

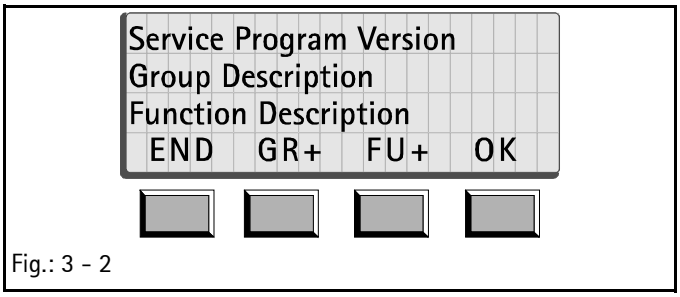


Fig.: 3 - 2

Activate the Service Program

1. Plug service connector on staff call socket at the rear of the unit. - ** appears in the display.
2. Select "Service Program" with the SM key. When the Service Program is activated the red alarm LED flashes. The LED displays the code number of the selected group and function.

Soft key functions

END	Jumps to the initial function
GR+	Selects group
FU+	Selects function in the activated group
OK	Activates the selected function or if necessary skips to sub-functions with NEXT

Note

When the service connector is plugged in the audible alarm is deactivated and only active during the switch-on test.

Quit the Service Program

1. Press END in the main menu. - A data storage query is activated: "Save changes? YES/NO".
   Modified values are only saved with the YES key.
   YES/NO terminates the Service Program. Press END to jump to the last function.
2. Switch off the Infusomat fm and remove service connector.

Note

Disconnect the Infusomat fm from mains for at least 30 seconds. Then the unit can be switched on again.

Unit Data

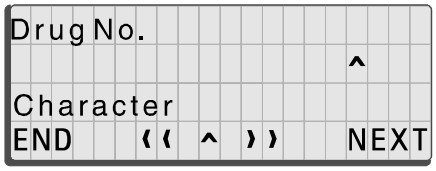


Fig.: 3 - 3

Software Version **Function 100**

1. Select sub-functions with NEXT.
2. The current software version is displayed in the LCD display:
   - User program version with date
   - Language with text version. Further languages with (+)
   - Service Program version
   - Service language with text version
3. Return to initial function with END.

Drug Name **Function 110**

Memory for maximum 10 drugs and 20 characters per name.

1. Display stored drug names with NEXT key.
2. Delete displayed entry with CLR.
3. Press YES to modify a drug name:
   Move cursor to character with NEXT.
   Select new character from line 3 with << or >>.
4. Repeat procedure for each character.
5. Return to initial function with END.

Ward Identification **Function 120**

Enter and display of a ward specific unit identification. Permanent display if the unit is connected to mains and switched off.

1. Delete displayed entry with CLR. Press YES to enter modifications:
   Move cursor to character with NEXT.
   Select new character from line 3 with << or >>.
2. Repeat procedure for each character.
3. Return to initial function with END.

Infusion Line (Tube Adapter) **Function 130**

The fitting position of the tube adapter is displayed.

Check that display and position of the adapter correspond after having exchanged the Reed sensors.

1. OK activates the display of the adapter position.
2. Return to initial function with END.

Serial Number **Function 140**

The displayed serial number must correspond with the number on the unit type plate, as this number is used in CC mode.

1. YES activates the entry mode. Enter via the numeric keyboard.

2. YES stores the changed or new number.
3. Return to initial function with END.

DIANET Type Number **Function 150**

The displayed serial number must correspond with the number on the unit type plate, as this number is used in CC mode.

1. YES activates the entry mode. Enter via the numeric keyboard.
2. YES stores the changed or new number.
3. Return to initial function with END.

History Data

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Code	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**

Example for alarm "Pump cover open"

0	Battery empty (battery alarm)
1	Pump cover open
2	Drop alarm
3	Air alarm
4	Pressure alarm
5	Expired standby time
6	CC alarm (interface)
7	KOR end alarm
8 to 14	free (insignificant)
15	Operating alarm

Fig.: 3 - 4

Operating Hour Counter **Function 200**

1. OK activates the display.
2. Return to initial function with END.

Battery Operating Hours **Function 210**

1. OK activates the display.
2. Return to initial function with END.

Pump Head Cycles **Function 220**

Display of the pump head cycles (delivered volume).

1. OK activates the display.
2. Return to initial function with END.

Operating Alarms **Function 230**

The last 20 operating alarms can be recalled.

They are displayed as 16 bit binary codes and each bit position can be set from 0 to 1.

1. OK activates the alarm display.
2. Display operating alarms 01 to 20 with the (+) and (-) key.
3. Delete the operating alarms with CLR (from software IFMB01001 or IFMB0001 on).
4. Return to initial function with END.

Alignment

Air Inline Sensor — Function 300

After exchange check function of the air inline sensor.

See TSC list for permissible check values.

For software IFMA00002 and IFMA00003

1. Press OK. "Observe Service Manual" is displayed.
2. Acknowledge with OK.
3. Insert an infusion line filled with air and check the maximum permissible air value.
4. Insert an infusion line filled with fluid and check the minimum permissible water value.
5. Return to initial function with END. The alignment which is possible in this software version must not be performed.

From software IFMB00001 or IFMB01001 on

6. Press OK. The received signal amplitude is displayed as a measured value.
   (The test value with NEXT is not important).
7. Insert an infusion line filled with air and check the maximum permissible air value.
8. Insert an infusion line filled with fluid and check the minimum permissible water value.
9. Return to initial function with END.

Pressure Control — Function 310

Test equipment: 4 mm gauge

(see „Test Equipment and Special Tools“ ➪ p. 9 - 1)

1. Push in bottom slide of the finger pump.
2. Press OK twice.
3. Open unit door.
4. Note the OIL value (actual value).
5. Insert 4 mm gauge and close the unit door.
6. The new OIL value is displayed. It must be 5 to 15 digits higher than the first value.
7. Return to initial function with END.

If the 5 to 15 digits are not reached, the pressure sensor unit must be mechanically adjusted (see „Pressure Sensor“ ➪ p. 4 - 18).

Unit Modifications

Service Language — Function 400

English or German can be selected.

1. OK activates the function.
2. Select language with NEXT.
3. Acknowledge with YES.
4. Return to initial function with END.

User Language — Function 410

Four user languages per language group are available (depending on software).

1. OK activates the function.
2. Select language with NEXT.
   The language no. and text version are displayed.
3. Acknowledge with YES.
4. Return to initial function with END.

Alarm Tone — Function 420

Different alarm modes can be selected:

Software IFMA00002 and IFMA00003

- Single stage: continuous tone 65 dBA.
- Double stage: alarm with reduced volume (50 dBA) for the first 2 minutes, then 65 dBA.

From software IFMB00001 or IFMB01001 on

- An additional "10 minutes off alarm" can be selected.
- In this mode the audible alarm is activated with a delay of 10 minutes.
- The activation of the "10 minutes off alarm" is only permissible if the staff call is connected and the Infusomat fm has an attention label (label drawing no. M007100000F04).

1. OK activates the function.
2. Select alarm tone with NEXT.
3. Acknowledge with YES.
4. Return to initial function with END.

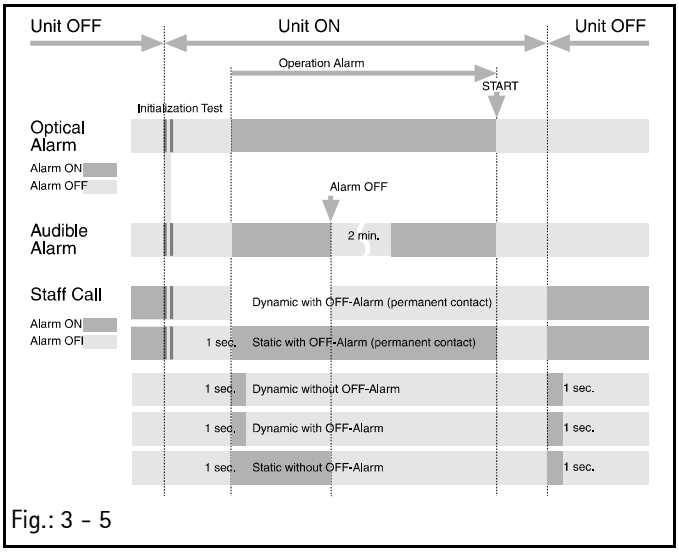


Fig.: 3 - 5

Staff Call **Function 430**

Different staff call modes can be selected:

Software IFMA00002 and IFMA00003

- Dynamic with OFF alarm (permanent contact).
- Static with OFF alarm (permanent contact).

From software IFMB00001 or IFMB01001 on

- Dynamic without OFF alarm
- Dynamic with OFF alarm.
- Static without OFF alarm

The self-test of the staff call relay during switching on has been cancelled. For further details see staff call line in the instructions for use.

1. OK activates the function.
2. Select staff call type with NEXT.
3. Acknowledge with YES.
4. Return to initial function with END.

Special Functions **Function 440 ****

Only available from software version IFMB 00001 / IFMB 01001 on.

Special functions can be activated in the Service Program, which are then displayed on the user interface. Deactivated special functions will not be displayed. The SM softkey will not be displayed in standard operation when all special functions are disabled. - Special functions to be selected:

- Standby function
- Drug selection
- CC mode
- Switch-off pressure
- Drop control
- Battery capacity
- Data lock
- Contrast setting

1. OK activates the function.
2. Select special functions with NEXT.
3. Activate / deactivate the respective function with YES/NO.

* software version IFMA00002 and IFMA00003
** from software IFMB00001 or IFMB01001 on
*** from software IFMB00002 on

4. Return to main menu with END.

Decimal Function **Function 450 ****

Only available from software version IFMB 00001 / IFMB 01001 on.

1. OK activates the function.
2. Activate / deactivate the decimal function with NEXT.
3. Acknowledge with YES.
4. Return to main menu with END.

Delivery Rate min/max **Function 460*****

The maximum and minimum delivery rates can be set. Range of adjustment of the delivery rate: 0.1 to 999.0 ml/h

1. OK activates the function.
2. Select min./max. delivery rate with NEXT.
3. Acknowledge with YES.
4. Enter value with a numeric key.
5. Acknowledge with OK.
6. Return to initial function with END.

Air Alarm **Function 470*****

The air inline sensor sensitivity of the air rate alarm in ml/h (total air alarm) and of the maximum air bubble in ml (single bubble) can be adjusted.
Setting range air rate: 0.5 to 3.5 ml/h
Setting range air bubble: 0.01 to 0.3 ml/h

1. OK activates the function.
2. Select air rate (ml/h) or air bubble (ml) with NEXT.
3. Acknowledge with YES.
4. Enter value with a numeric key.
5. Acknowledge with OK.
6. Return to initial function with END.

* software version IFMA00002 and IFMA00003
** from software IFMB00001 or IFMB01001 on
*** from software IFMB00002 on

Calibration

Note

All safety relevant parameters are set by the manufacturer. If these parameters are changed, a new calibration must be performed with calibrated test equipment.

Note

Only enter the scale factor values and pressure sensor values for OIL (Original Infusomat Line). Values for OIL-FM (Original Infusomat Line FM) are not applicable. This infusion line is no longer available.

Pump Head **Function 500***

1. Software IFMA:

   Software module "Calibration Pump Head" for the entry of scale factor and pressure sensor data.

2. From software IFMB00001 or IFMB01001 on:

   The entry groups pump head and pressure sensor are separate functions to avoid operating faults.

   - Calibration pressure sensor: function 500
   - Calibration scale factor: function 510.

Pressure Sensor Data **Function 500****

Calibration (see „Pressure Sensor“ ➪ p. 4 - 18).

Scale Factor **Function 500* or 510****

The scale factor can be set in the limits 40 to 99 digits. Every digit step is equivalent to a 0.5 % modification of the delivery rate. An increase of the scale factor reduces the pump speed, and a decrease increases the pump speed.

1. OK activates the function.
2. The value can be changed with the entry keyboard.
3. Acknowledge with YES.
4. Return to initial function with END.
5. Quit the Service Program and save changes with YES.
6. Switch on unit and check delivery rate (see „General Pressure Measurement“ ➪ p. 8 - 3). If necessary repeat the delivery rate measurement.

* software version IFMA00002 and IFMA00003
** from software IFMB00001 or IFMB01001 on
*** from software IFMB00002 on

Air Inline Sensor **Function 510* or 520****

Alignment or check of the air inline sensor threshold value (see „Air Inline Sensor“ ➪ p. 4 – 20).

1. OK activates the function.
2. Press OK again to call in the air inline sensor value.
3. The value can be changed with the entry keyboard.
4. Acknowledge with YES.
5. AIR INLINE SENSOR IS SET acknowledges the entry.
6. Return to initial function with END.
7. Quit the Service Program and save changes with YES.

* software version IFMA00002 and IFMA00003
** from software IFMB00001 or IFMB01001 on
*** from software IFMB00002 on

3 Service Program

For your notes:

Unit Elements 4

4.1 Mains Fuses

Designation	Ord. No.
Fuse T 0.16 A for 200-240 V (10 pcs.)	3477 2847
Fuse T 0.315 A for 100-120 V (10 pcs.)	3477 0534
Fuse holder	3450 5652

Note

Only use recommended fuses.

Exchange

1. Press the expansion clamps at the fuse holder on the recessed mains plug with a screw driver in direction of the arrows and pull out fuse holder.
2. Replace blown fuses and press in fuse holder.

Check

Electrical safety, functional check.

4.2 Battery

Applicable types: Long time battery 1.8 Ah, short time battery 0.5 Ah

Designation	Ord. No.
Battery incl. connector plug, 1.8 Ah / 7.2 V	3450 6357
Cover for battery compartment	3450 5504

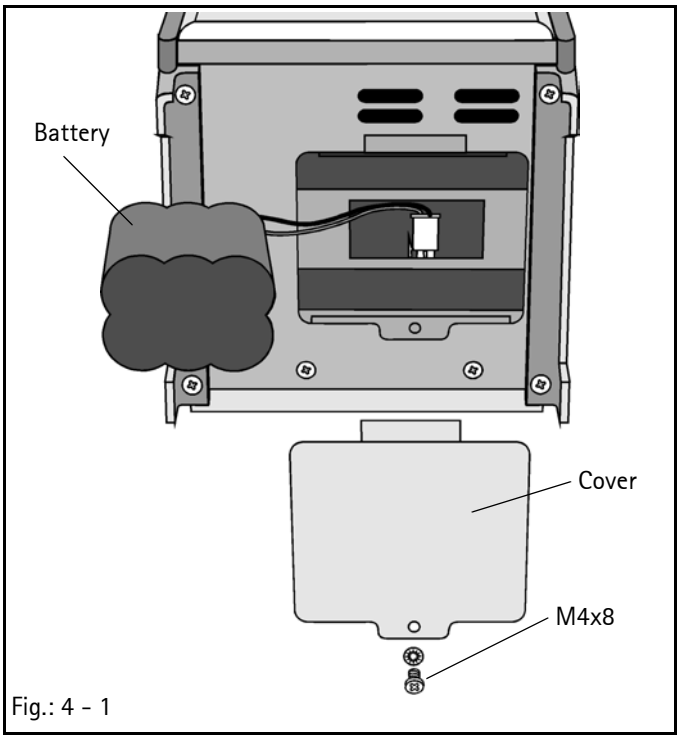


Fig.: 4 - 1

Exchange

Tools: Pointed pliers

1. Switch off unit and disconnect from mains.
2. Open cover of the battery compartment.
3. Remove battery from the battery compartment.
4. Pull off battery plug with pointed pliers.
5. Assembly is done in reverse order.
6. After having exchanged the battery connect Infusomat fm to mains (thereby the charge and discharge current are balanced).
7. Recharge battery (16 h).

Check

Perform switch-on test in battery operation and check the battery running time, if necessary.

4.3 Door Lock

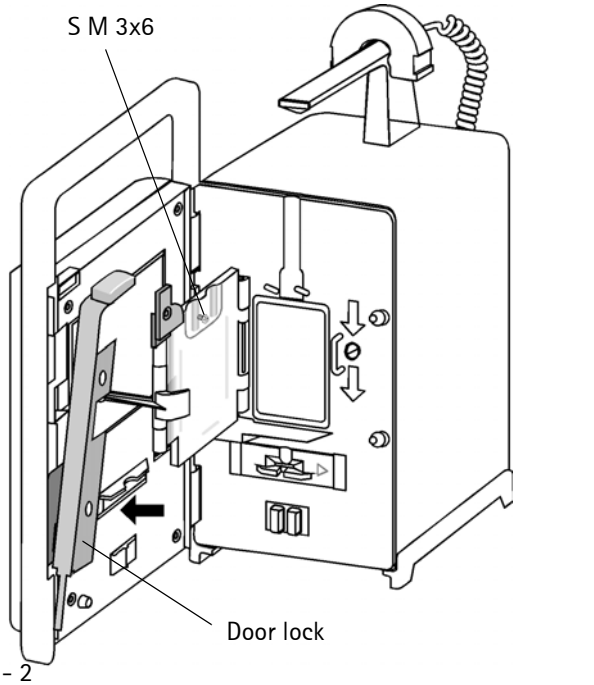


Fig.: 4 - 2

Designation	Ord. No.
Door lock complete with push button	3450 5601
Spring holder for door lock	3450 5440
Fixture for door lock	3477 2790

Exchange

1. Open door and disassemble countersunk screw under the door lock button.
2. Press fixture for the door lock forward and remove fixture.
3. Press spring holder down with a screwdriver through the bottom hole and unlatch.
4. Pull door lock forward and lift door lock.
5. Remove door lock in an upward direction and exchange.
6. Assembly is done in reverse order.

Check

Pump unit check (only mechanical pressure control).

4.4 Pump Cover

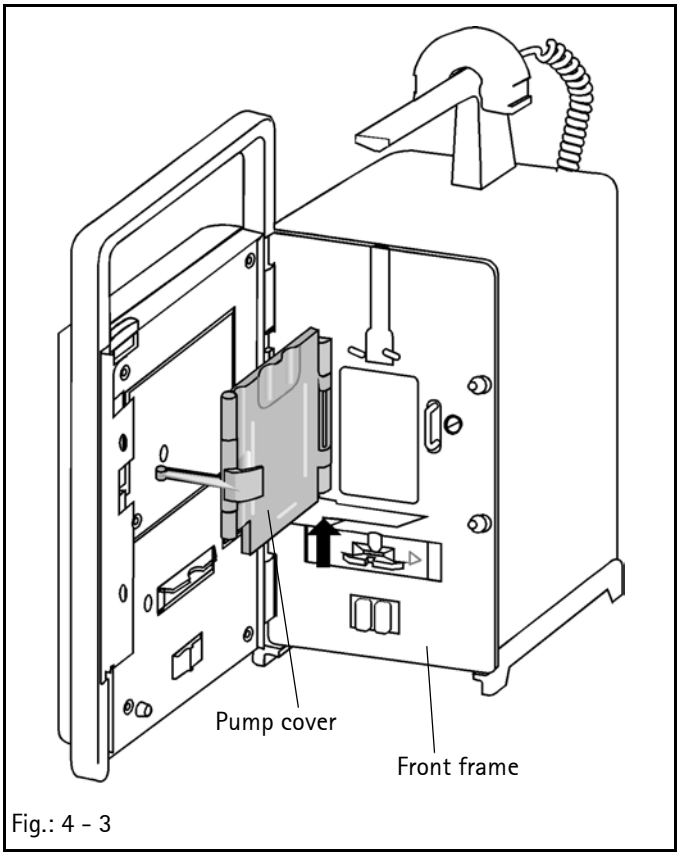


Fig.: 4 - 3

Designation	Ord. No.
Pump cover with lock	3450 5717
Blind plug 7.1 mm (10 pcs.)	3477 3207
Torsion spring in lever / pump cover (5 pcs.)	3477 3363
Torsion spring for pump cover (5 pcs.)	3477 3355
Lever (pump cover)	3477 4092
Hinge pin for pump cover	3477 3967
Hinge pin for pump cover lever	3450 5725

Exchange

Tools: Pin punch 1.8mm, pin punch 6mm, 4mm gauge

1. Open door and remove hinge pin with pin punch (1.8 mm) from below. Do not lose torsion spring.
2. Disassemble pump cover.
3. Insert the torsion spring in new pump cover and assemble.
4. Press hinge pin from the top in the holder with a pin punch.
5. Check pressure sensor with 4mm gauge in the Service Program, and calibrate, if necessary.

Check

Electrical safety, pump unit check.

4.5 Housing

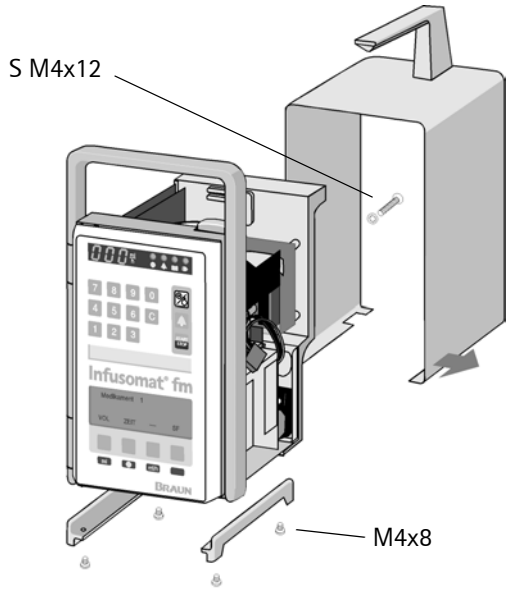


Fig.: 4 - 4

Designation	Ord. No.
Housing labelling	
German	3450 5610
French	3450 5946
Dutch	3450 5954
Italian	3450 5962
English	3450 5970
Spanish	3450 5989
Danish	3450 5997
Norwegian	3450 6101
Swedish	3450 6110
Finnish	3450 6128
Portuguese	3450 6136
Czech	3450 6144
Polish	3450 6152
Castellano	3450 6160
Turkish	3450 6179
Label for short instructions for use	3450 8651
Foot stand complete with rubber feet	3450 5415
Rubber feet (20 pcs.)	3477 3096

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Turn unit upside down and remove the 4 screws from the foot stands. Remove foot stands.
3. Place unit upright, remove safety seal from the rear panel, and break the tamper-proof cap.
4. Remove countersunk screw and serrated lock washer (rear side).
5. Slightly widen the sides at the bottom of the housing and pull off to the top. Do not damage the microprocessor board.
6. Assembly is done in reverse order.
7. Safety seal the rear panel screw after functional check.

Check

Electrical safety.

4.6 Handle

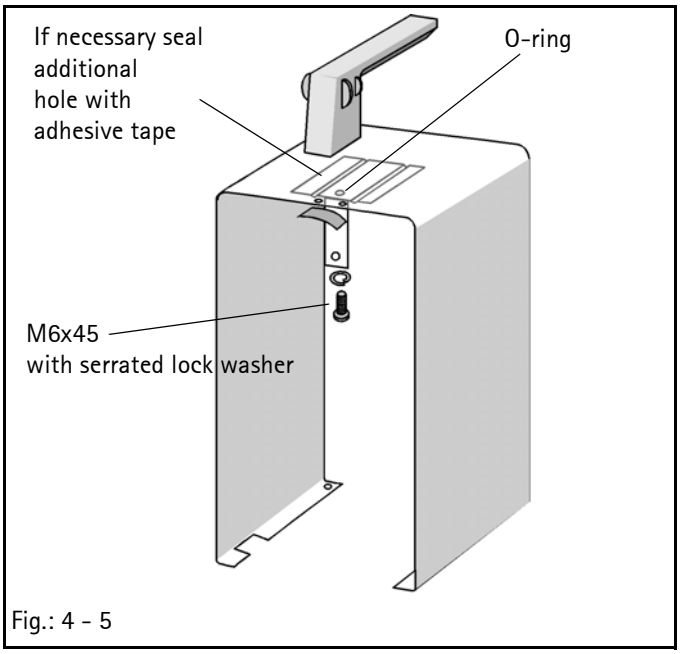


Fig.: 4 - 5

Designation	Ord. No.
Handle	3450 5512
O-ring (20 pcs.)	3477 1530

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Remove the screw from handle/housing.
4. Assemble new handle. Be sure that the knobs are seated in the guides. Seal screw-holes with O-ring.

Check

Electrical safety.

4.7 Microprocessor Board

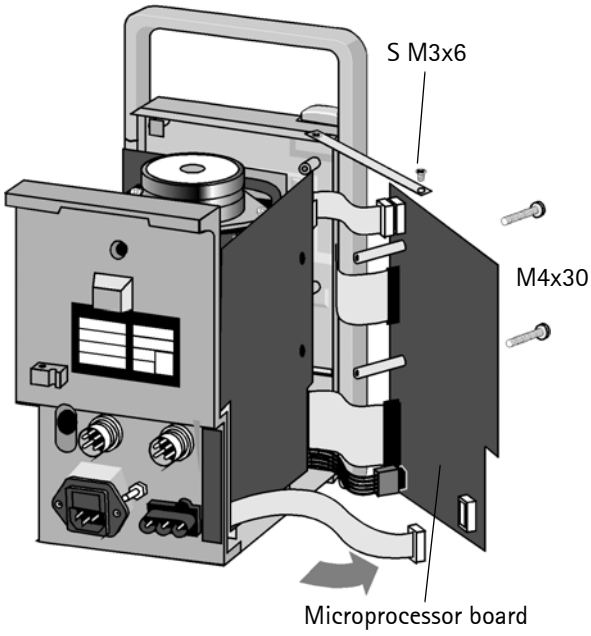


Fig.: 4 - 6

Designation

Microprocessor boards with different software versions can be used. The user must be informed about the modified software versions (see „Software Update“ ➪ p. 2 - 1).

The boards with the raw material no. 3810 6221*, 3810 6914*, 3810 6973 and 3810 7228 have different membrane plugs. Please pay attention when ordering boards.

* Raw material no. 3810 6221 and 3810 6914 only as exchange parts. If you wish to order new parts please use raw material no. 3810 6973 or 3810 7228.

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Loosen countersunk screw and bridge.
4. Remove both screws of the board.
5. Carefully swivel out microprocessor board from the guide.
6. Pull off plugs E1 to E5 and disconnect the flexible cable.
7. Exchange the microprocessor board.
8. Assembly is done in reverse order.

Do not damage the optical components. Make sure that the rear panel guide and the fm recessed plug are correctly seated.

Note

Inform the user if functions have been modified due to the exchange of the board (software IFMA00xxx / IFMB00xxx, see software coding), exchange the instructions for use, if necessary.

Check

Electrical safety, functional check.

Language Group*	New Part	Exchange
A	--	Ord.No.:3488 045B
B	--	Ord.No.:3488 048B
C	--	Ord.No.:3488 050B
D	--	Ord.No.:3488 052B
E	--	Ord.No.:3488 054B

Table 4 - 1

Microprocessor Board
(raw material no. 3810 6221 replaces raw material no. 3810 7228)

Delivery with:

- Membrane plug (Dupont blue)
- Software IFMA00xxx (update to IFMB00xxx possible).

Compatible with display board, order no. of display boards (see „Display Board“ ➪ p. 4 – 25)
(raw material no. 3810 6205)

Language Group*	New Part	Exchange
A	Ord. No.:3450 6233	Ord.No.:3488 0607
B	Ord. No.:3450 6195	Ord.No.:3488 0569
C	Ord. No.:3450 6209	Ord.No.:3488 0577
D	Ord. No.:3450 6217	Ord.No.:3488 0585
E	Ord. No.:3450 6225	Ord.No.:3488 0593

Table 4 - 2

Microprocessor Board
(raw material no. 3810 6973 replaces raw material no. 3810 6914)

Delivery with:

- Membrane plug (AMP black).
- Software IFMB01xxx.

Compatible with display board, order no. of display boards (see „Display Board“ ➪ p. 4 – 25)
(raw material no. 3810 6906, AMP label and flex cable).

* Language Group:
A German, French, Dutch, Italian
B English, Dutch, Spanish, Castellano
C Danish, Norwegian, Swedish, Finnish
D Spanish, Portuguese, English (BSI), English, Turkish
E Czech, Polish

4.8 Analog Board

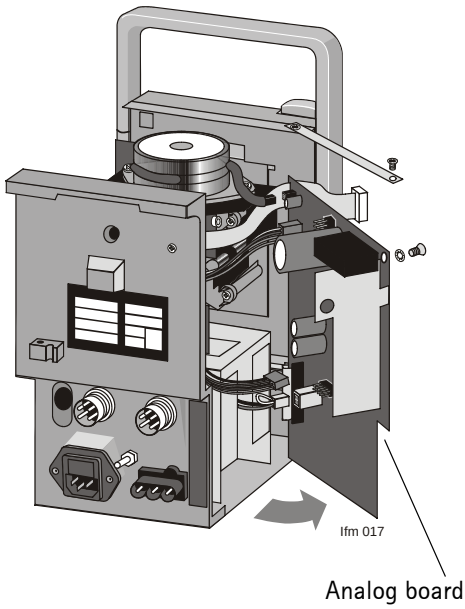


Fig.: 4 - 7

Designation	Ord. No.
Analog board new part	3450 580B
Analog board exchange	3488 047B
Fuse T 1.6 A on analog board (10 pieces)	3477 3312

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble the microprocessor board (see „Microprocessor Board“ ➪ p. 4 - 6).
4. Remove screw with the serrated lock washer on the analog board.
5. Disconnect the 3 plugs from motor, rear panel wiring and drop/air inline sensor connections.
6. Exchange the analog board.
7. Position Pertinax cover over the battery socket.
8. Assembly is done in reverse order.

Check

Electrical safety, functional check.

4.9 Rear Panel

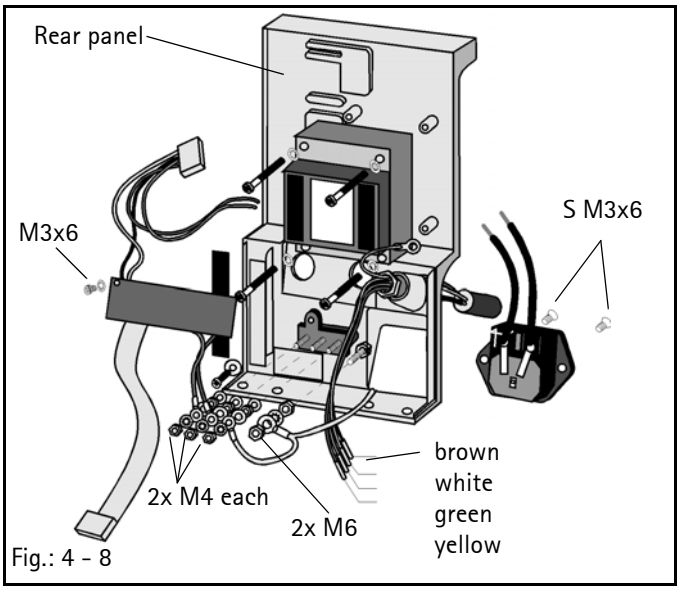


Fig.: 4 - 8

Designation	Ord. No.
Rear panel without accessories	3450 5628
Cover for optical interface	3477 3164
Sealing strip for rear panel	3477 3142

Exchange

1. Tools: Special socket spanner M18
2. Remove battery (see „Battery“ ➪ p. 4 - 1).
3. Dismount cover (see „Housing“ ➪ p. 4 - 4).
4. Disassemble microprocessor board (see „Microprocessor Board“ ➪ p. 4 - 6) and analog board (see „Analog Board“ ➪ p. 4 - 8).
5. Turn unit to one side. Remove 2 screws with serrated lock washers from the bottom side.
6. Place unit upright. Swivel rear panel aside and remove the wires (brown, white, green, yellow) out of the plug (do not damage the crimp terminals).
7. Disassemble all components from the rear panel.
8. Exchange rear panel. Assembly is done in reverse order. Safety lock the transformer screws with Loctite 242 e.

Check

Electrical safety, functional check.

4.10 Drop Sensor Socket

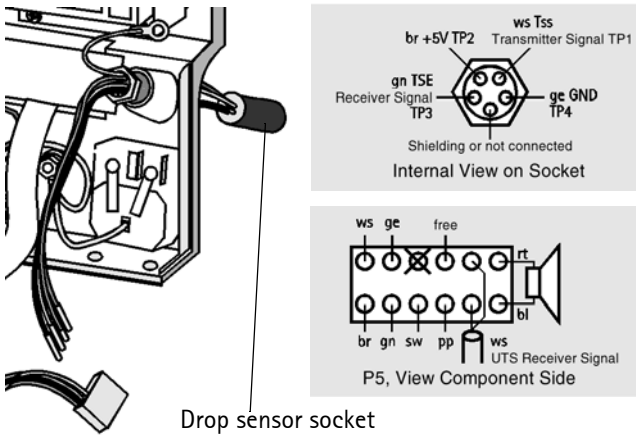


Fig.: 4 - 9

Designation **Ord. No.**

Drop sensor socket incl. cable and plug 3450 5687

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove 4 wires (brown, white, green, yellow) out of the plug (do not damage the crimp terminals).
5. Loosen nut and exchange the drop sensor socket.
6. Safety lock nut and socket (Sicomet 50).
7. Connect the 4 wires.
8. Make connection to ground (at the fixture of the mains transformer).
9. Assembly is done in reverse order.

Check

Electrical safety.

The connection cable of the drop sensor from serial no. 15626 is shielded. If the shielded version is retrofitted check that the drop sensor socket (middle pin) is connected with the rear panel. Retrofit if necessary (compare with point 8).

4.11 Rear Panel Board

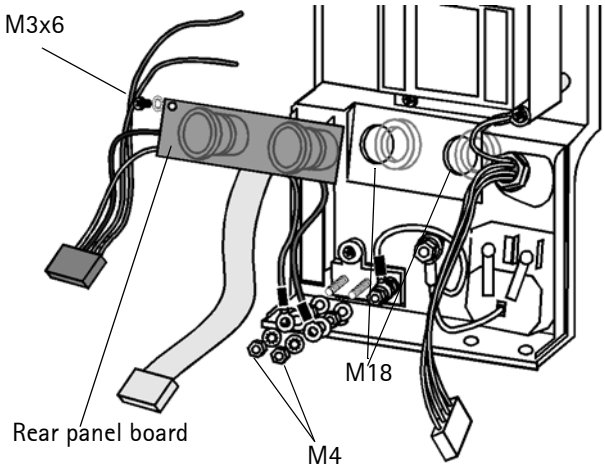


Fig.: 4 - 10

Designation	Ord. No.
DIANET recessed plug (8 pin)	3450 5679
Staff call recessed plug (5 pin)	3450 5660
Rear panel board	
with 5 and 8 pin recessed plugs	
with 5V TTL interface	3450 5636
with RS232 interface	3450 563A

Exchange

Tools: Special socket spanner M18

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove screw on the rear panel board.
5. Remove crimp terminals (red/blue).
6. Remove nuts from the fm recessed plug (red/blue).
7. Remove coupling ring from the staff call plug and the 12V recessed plug (socket spanner M18). Exchange rear panel board or the DIANET/staff call recessed plug.
8. Assembly is done in reverse order.

Supplementary Information

The DIANET interface (PC connection) is designed as a 5V TTL interface until unit No. 17147. From unit No. 17148 an RS232 interface is present. Older units can be retrofitted by exchanging the rear panel board.

Please pay attention to the microprocessor board model when retrofitting a rear panel board with an RS232 interface:

- Modification not necessary with microprocessor board order no. 3810 6221 index C.
- Perform retrofitting with microprocessor board order no. 3810 6221 until index B (see „3. Modification of the Interface from 5V TTL to RS232“ ➪ p. A - 2) or exchange board by a current type.

Check

Electrical safety, functional check.

4.12 fm Recessed Plug

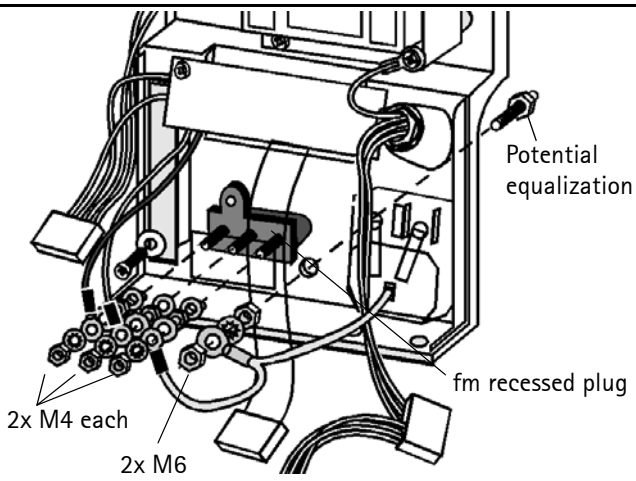


Fig.: 4 - 11

Designation **Ord. No.**

fm recessed plug (3 pin) 3477 3177

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove nuts from the fm recessed plug (green/yellow, red, blue).
5. Remove screw with washer.
6. Slightly bend recessed plug to the top and pull out to the rear.
7. Assemble new recessed plug. After assembly the plug must be slightly moveable.
8. Assembly is done in reverse order.

Check

Electrical safety.

4.13 Potential Equalization Bolt

Designation **Ord. No.**

Potential equalization bolt 3477 0550

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove nuts with ring spanner. Exchange bolt (see above figure).

Check

Electrical safety.

4.14 Recessed Mains Plug

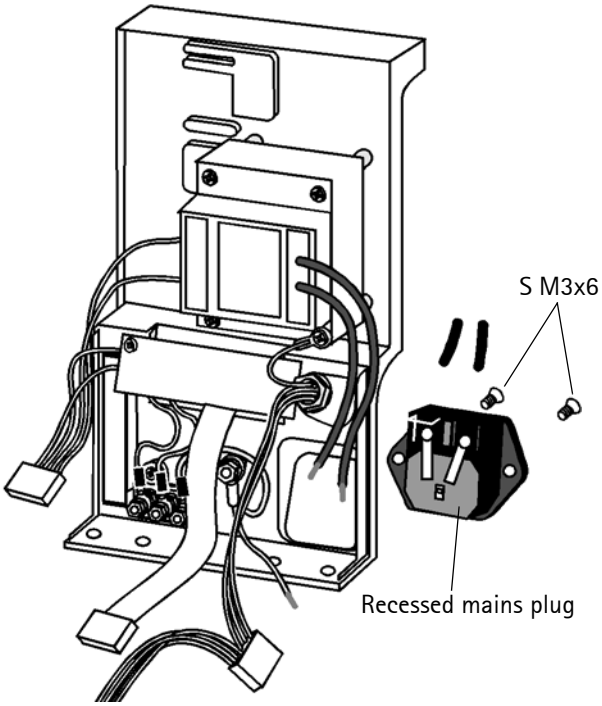


Fig.: 4 - 12

Designation **Ord. No.**

Recessed mains plug without fuse holder 3450 5644

Fuse holder 3450 5652

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove shrink tube from the cable terminals.
5. Unsolder the connection cables (L/N/SL).
6. Loosen countersunk screws and exchange recessed mains plug.
7. Install new shrink tube.
8. Solder the cables and insulate with shrink tube. Make sure that the terminal assignment is correct.
9. Assembly is done in reverse order.

Check

Electrical safety.

4.15 Mains Transformer

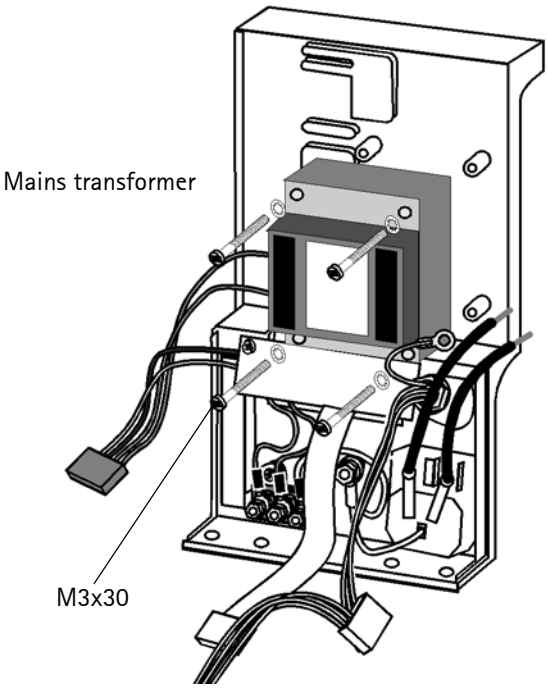


Fig.: 4 - 13

Designation **Ord. No.**

Mains transformer 200-240 V 3450 5709

Mains transformer 100-120 V. 3450 5695

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble rear panel (see „Rear Panel“ ➪ p. 4 - 9).
4. Remove shrink tube from the transformer cable terminals and unsolder the connection cables.
5. Loosen screws with serrated lock washers and washer.
6. Disassemble the mains transformer.
7. Assemble new mains transformer. Safety lock the 4 screws with Loctite 242e!
8. Install new shrink tube. Solder the connection cables and insulate with shrink tube.
9. Assembly is done in reverse order.

Check

Electrical safety, functional check.

4.16 Reed Sensor Set

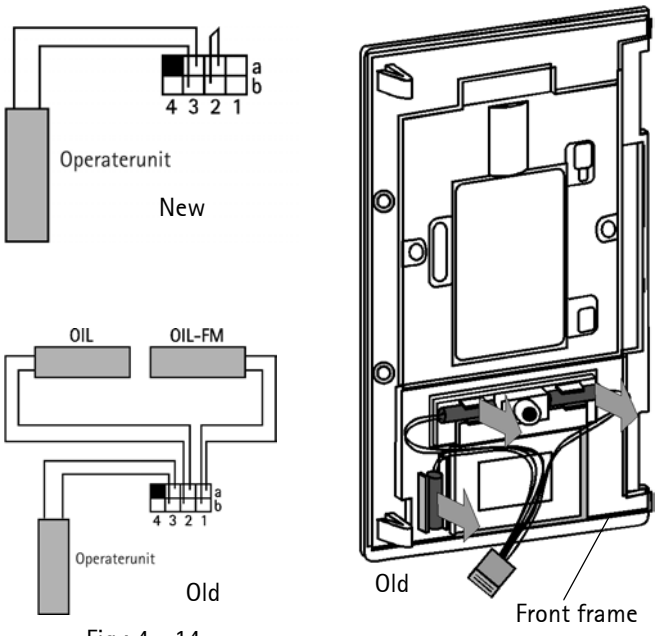


Fig.: 4 - 14

Designation	Ord. No.
Reed sensor set	
Sensor incl. 8 pin socket plug	3450 5814
Reed sensor incl. crimp terminals	3450 5431
Socket plug (AMP/100 pin)	3451 3744

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble front frame (see „Front Frame“ ➪ p. 4 - 15).
4. Press out Reed sensor set from the holder and exchange.
5. Assembly is done in reverse order. Do not squeeze the cables.

Note

The Infusomat fm is only equipped with the OIL (Original Infusomat Line) from serial no. 33202 on. The Reed sensors for OIL and OIL-FM are not applicable and are replaced by a bridge from pin 2a and 2b.

Check

Electrical safety, check of pump unit, tube type test in Service Program (only with the tube adapter version).

4.17 Front Frame

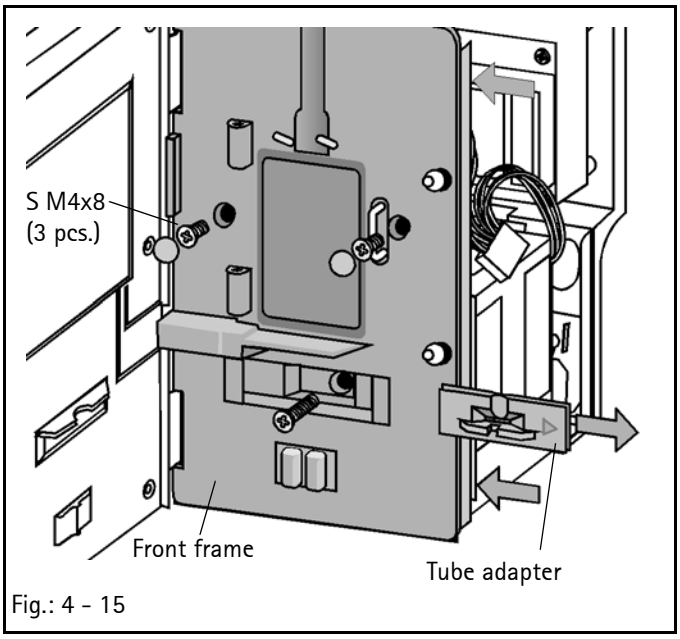


Fig.: 4 - 15

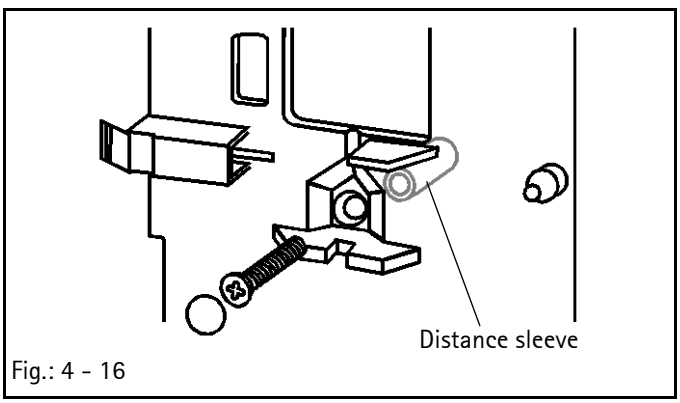


Fig.: 4 - 16

Designation	Ord. No.
Front frame without flow inhibitor and pressure spring. with distance sleeve and countersunk screw	3450 5822
Circular seal behind front frame	3477 3126
Flow inhibitor with pressure spring	3477 3258
Pressure spring for flow inhibitor (5 pcs.)	3477 3266
Tube adapter with magnet	3450 5830
Magnet for tube adapter	3450 5849

Exchange

Tools: Pin punch

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble pump cover (see „Pump Cover“ ➪ p. 4 - 3).
4. Push the tube adapter in arrow direction and remove (only up to serial no. 33 201).
5. Remove tamper-proof caps by piercing a screwdriver through the caps.
6. Loosen countersunk screws.
7. Remove front frame by pressing the snap-in pins inwards on the outer side of the frame (rear side) and pull off frame to the front.
8. Remove flow inhibitor with pressure spring and Reed sensors and assemble in new front frame.
9. Assembly is done in reverse order. Make sure that the tube adapter is correctly assembled and that the cable run of the Reed sensors is correct. Snap-in pins manually.

Note

Up to serial no. 5878: Exchange complete front frame with flow inhibitor. – Up to serial no. 33 201 (from 10/96): Use distance sleeve (17.5 mm) and countersunk screw M4x25 when the front frame is exchanged. Remove OIL and OIL-FM sensors, plug bridge in connector position 2a-2b (see „Reed Sensor Set“ ➪ p. 4 - 14).

Check

Electrical safety, pump unit check.

4.18 Pump Unit

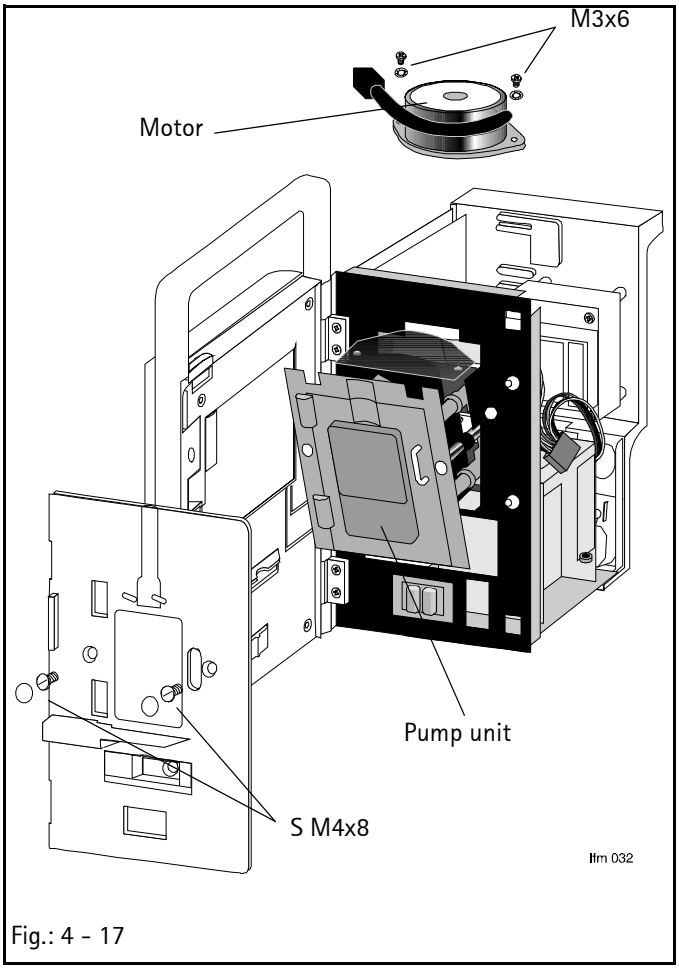


Fig.: 4 - 17

Designation	Ord. No.
Finger pump (without motor) including pump, pump cover, seal membrane and boards	3450 5407
Finger pump (without motor and board) incl. pump, pump cover, and seal membrane	3450 9038
Membrane for pump unit	3450 5733
Motor with pinion	3450 5741

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble front frame (see „Front Frame“ ➪ p. 4 - 15).
4. Loosen motor screws, pull off motor connector and remove motor from pump unit.

Note

Do not loosen the mounting screw on the lower pressure sensor board! Otherwise the pump has to be recalibrated with a 4mm gauge.

5. Pull off connector from the microprocessor board.
6. Press down snap-in pins (from the inside) and tilt pump forward. Slightly pull the pump unit up and unhinge the bottom side.
7. Tilt to front and pull out the unit.
8. Assembly is done in reverse order. The ribbon cable must not hinder the pump movement.
9. Enter user data in the EEPROM (see below).

The complete pump unit (pump without motor, pump cover, membrane, boards) was calibrated by B.Braun. After a complete exchange of the pump unit the unit data and the user data must be entered in the Service Program again as the data memory is on the pump board:

- Serial number
- Dianet type no.

If necessary enter:

- Drug name
- Special functions (ON/OFF)*
- Decimal function (ON/OFF)*

- Delivery rate min./max. **
- Air alarm**
- Ward identification
- Alarm tone
- User language
- Staff call

If data is not entered, "Calibration data faulty" may be displayed after the unit is switched on again.

After terminating the Service Program save the data.

The counters for operating hours, battery operation and pump head cycles are reset to zero when the pump unit is exchanged.

If "Calibration data faulty" is displayed, select the Service Program and quit with "Save? Yes".

Check

Electrical safety, pump unit check.

* from software IFMB00001 / 01001 on
** from software IFMB00002 / 01002 on

4.19 Pressure Sensor

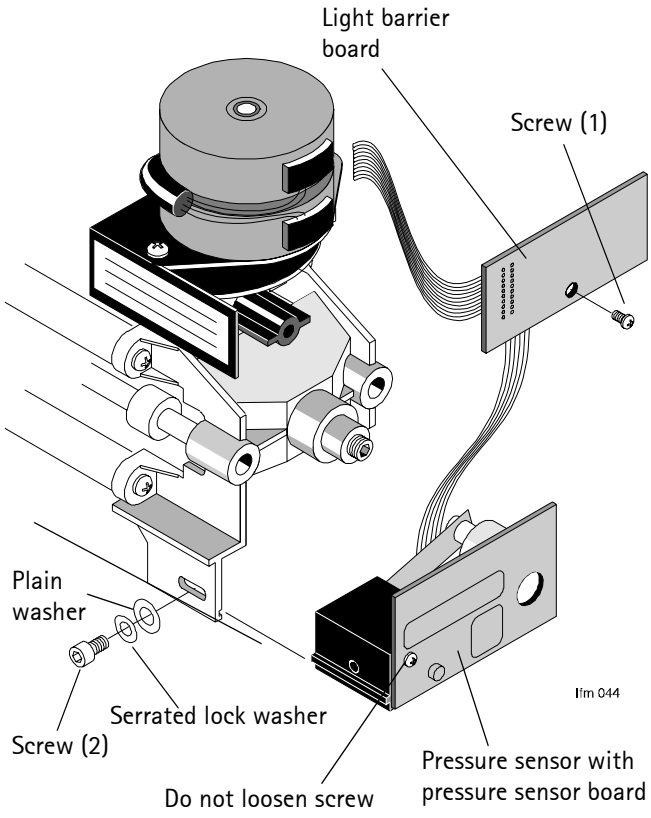


Fig.: 4 - 18

Test Equipment	Ord. No.
Pressure calibration device	0770 5018
Calibration gauge 4 mm (for adjustment after exchange of the pump cover)	0770 1489

Designation	Ord. No.
Pressure sensor (cpl.) (only delivered when a pressure calibration device is available)	3450 7345

Exchange

CAUTION

The pressure sensor unit is mechanically very sensitive. It must not be dismounted, which means that the pressure sensor board and the spring element must not be detached from the pressure sensor support (plastic part). Make sure that the movement of the coil core inside the coil is not hindered.

The pressure sensor consists of the light barrier board with EEPROM and the pressure sensor board with holder. Coil core and bending element are screwed to this holder. Both boards are connected via a flat cable.

1. Dismount rear panel (see „Rear Panel“ ➪ p. 4 - 9) or pump unit (see „Pump Unit“ ➪ p. 4 - 16).
2. Pull off the connection cable to the microprocessor board.
3. Loosen and remove screw (1) of the light barrier board.
4. Loosen screw (2) of the pressure sensor and remove it together with plain washer and serrated lock washer. Then remove pressure sensor with pressure sensor board and light barrier board.
5. Mount new pressure sensor.

Note

Make sure that the pressure sensor slide can smoothly run in the guides and that the coil core can move inside the coil.
The serrated lock washer must be mounted, if necessary retrofit (see Fig.: 4 - 18).

6. Adjusting the pressure sensor
   a) Call the pressure display in the Service Program (see „Alignment“ ➪ p. 3 - 6).
   b) Loosen hexagon socket screw (M 3x6) on the pressure sensor unit (with a 2.5 mm Allen key).

c) Push the pressure sensor unit with board slightly forward or backward.

d) Tighten the Allen screw.

e) The new OIL value will be displayed (repeat if necessary until the value is increased by 5 to 15 digits).

f) Return to the initial function with END. - Select SAVE NO. (Do not actuate the YES key.)

g) Switch off unit.

7. Assembly is done in reverse order.
8. Check the user data and reenter, if necessary, as data was saved in the EEPROM of the exchanged light barrier board.
9. Calibrate pressure sensor:

WARNING

NEVER OPERATE THE UNIT WITH PLUGGED IN SERVICE CONNECTOR ON THE PATIENT. WHEN THE UNIT WAS OPERATED WITH PLUGGED IN SERVICE CONNECTOR IT IS TO BE SWITCHED OFF ONCE BEFORE ANY FURTHER USE.

Note

To calibrate the pressure sensor a pressure calibration device is required. An alignment with infusion lines is not permitted.

a) Clean the pump front side.

b) Place the Infusomat® fm without mains lead and drop sensor and the service connector plugged in horizontally (front facing upwards) in the cellular packing of the calibration device.

c) Call function 310 in the Service Program **(see „Pressure Control Function 310“ ➪ p. 3 – 6)**.

d) Open pump cover.

e) Fasten holders for the calibration weights under the pump cover and let snap in at the locking bow.

f) Position weight 1 (100 g) for 400 mbar carefully on the pressure sensor. The weight must be placed without any friction in the holder.

g) Note and confirm the measured value.

h) Repeat steps 7. and 8. with weight 2 (128 g) for 800 mbar and weight 3 (166 g) for 1200 mbar. Confirm the measured value for 800 mbar.

i) Remove the holder and do **not** save data.

j) Call function 500 in the Service Program and confirm "Change calibration OIL" with "Yes".

k) Enter the calibration values via the keyboard and acknowledge with "Yes".

l) Quit function in the Service Program and save data.

m) Register the changed pressure values in the unit book.

n) Check the electronic pressure control (see „Electronic Pressure Control (Pressure Sensor)" ➪ p. 8 - 3).

Check

Electrical safety, functional check.

4.20 Air Inline Sensor

The analog board must be additionally exchanged for boards without an index. There are modified calibration and check values for the air inline sensor. Enter the new calibration value for every unit in the Service Program under CALIBRATION AIR INLINE SENSOR.

Designation	Ord. No.
Air inline sensor with crimp terminals	3450 5750

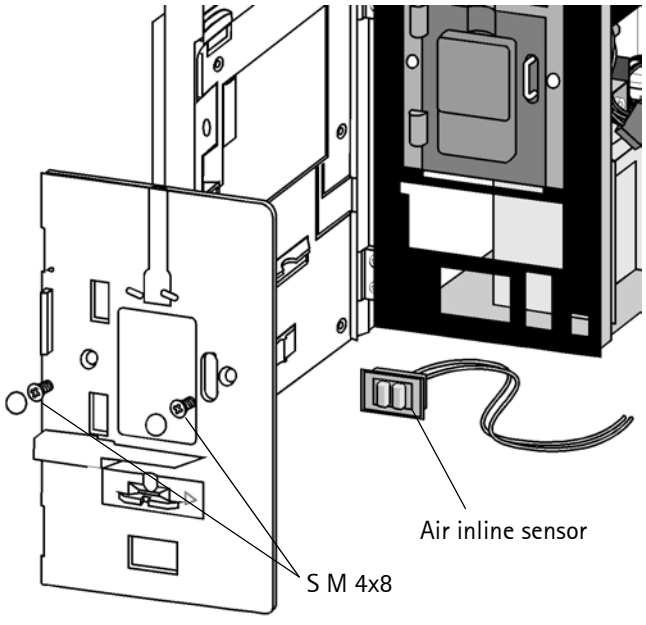


Fig.: 4 - 19

Exchange

1. Remove battery (see „Battery" ➪ p. 4 - 1).
2. Dismount cover (see „Housing" ➪ p. 4 - 4).
3. Disassemble front frame (see „Front Frame" ➪ p. 4 - 15).
4. Press the complete sensor out of the frame.
5. Remove terminals from the connector.
6. Assemble cable to the connector (check tight seat).
7. Assembly is done in reverse order.

Check

After exchange of the air inline sensor:

- Check air value
- Check water value
- Check calibration value (alarm threshold), adjust if necessary

Electrical safety, functional check.

4.21 Alarm Buzzer

Designation	Ord. No.
Buzzer incl. seal ring	3450 5776

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).

Check

Electrical safety, functional check.

4.22 Air Insulation Board

Designation	Ord. No.
Air insulation board	3450 6187

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Pull off connector P1 from board.
4. Remove screws (2 M 3x16) with distance sleeve (12 mm) from the air insulation board, exchange the board.
5. Assembly is done in reverse order.

Check

Electrical safety, function check, air value in the Service Program.

4.23 Frame with Seal Plate

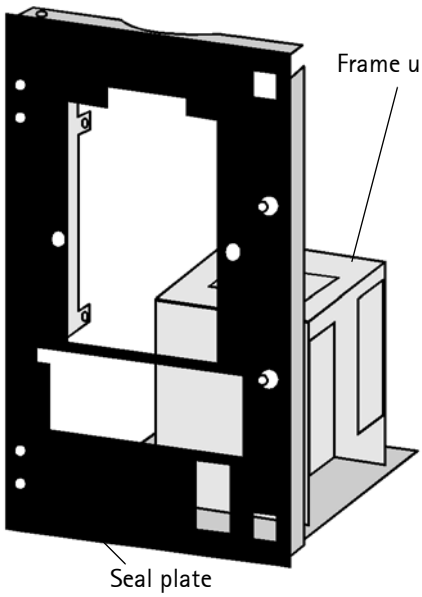


Fig.: 4 - 20

Designation **Ord. No.**

Frame unit with seal plate 3450 5466

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Disassemble pump cover (see „Pump Cover“ ➪ p. 4 - 3).
4. Disassemble the microprocessor board (see „Microprocessor Board“ ➪ p. 4 - 6), analog board (see „Analog Board“ ➪ p. 4 - 8) and the rear panel.
5. Disassemble front frame (see „Front Frame“ ➪ p. 4 - 15).
6. Disassemble door frame (see „Door Frame“ ➪ p. 4 - 23).
7. Disassemble pump unit (see „Pump Unit“ ➪ p. 4 - 16).
8. Disassemble air inline sensor (see „Air Inline Sensor“ ➪ p. 4 - 20).
9. Exchange the frame unit with seal plate.
10. Assembly is done in reverse order.

Check

Electrical safety, functional check, pump unit check.

4.24 Door Frame

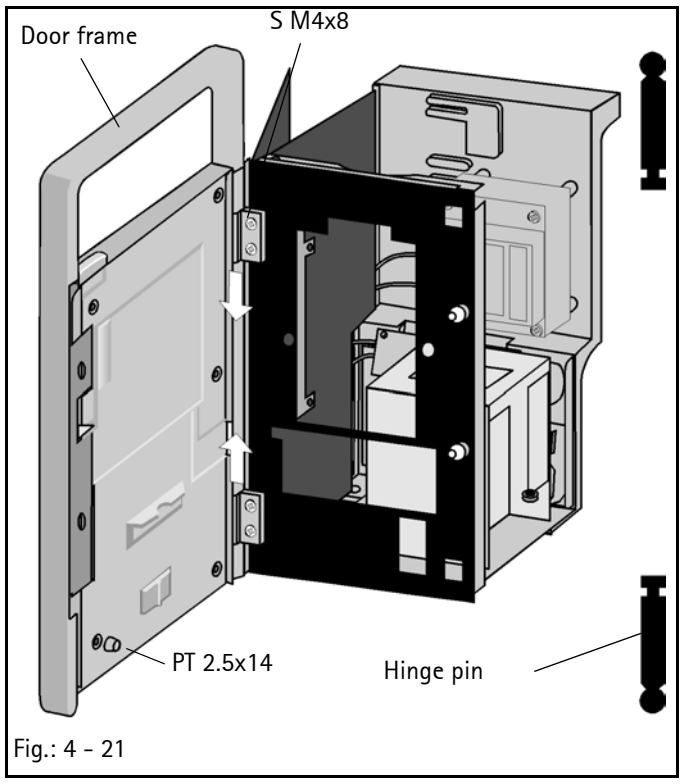


Fig.: 4 - 21

Designation	Ord. No.
Door frame incl. pressure spring and magnet without door lock	3450 5598
Seal for door frame / flexible cable (5 pcs.)	3477 3347
Hinge unit	3450 5571
Hinge pin for hinge unit	3450 5580

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Loosen the countersunk screw (M 3x6) and bridge.
4. Swivel out the microprocessor board.
5. Disconnect flexible cable from the display board.
6. Disassemble pump cover (see „Pump Cover“ ➪ p. 4 - 3).
7. Disassemble front frame (see „Front Frame“ ➪ p. 4 - 15).
8. Remove countersunk screws from hinge.
9. Disassemble door lock (see „Door Lock“ ➪ p. 4 - 2).
10. Pull out the door frame to the front and take care not to damage the cables.
11. Disassemble the door hinge pin. Pay attention to correct orientation during assembly.
12. Remove tamper-proof caps (6 pieces) on the door frame by piercing a screwdriver through the caps.
13. Loosen screws.
14. Remove support plate with modules from the door frame.
15. Exchange the door frame. Do not forget the seal.
16. Assembly is done in reverse order.

Check

Electrical safety, functional check, pump unit check.

4.25 Membrane Keyboard with Support Plate

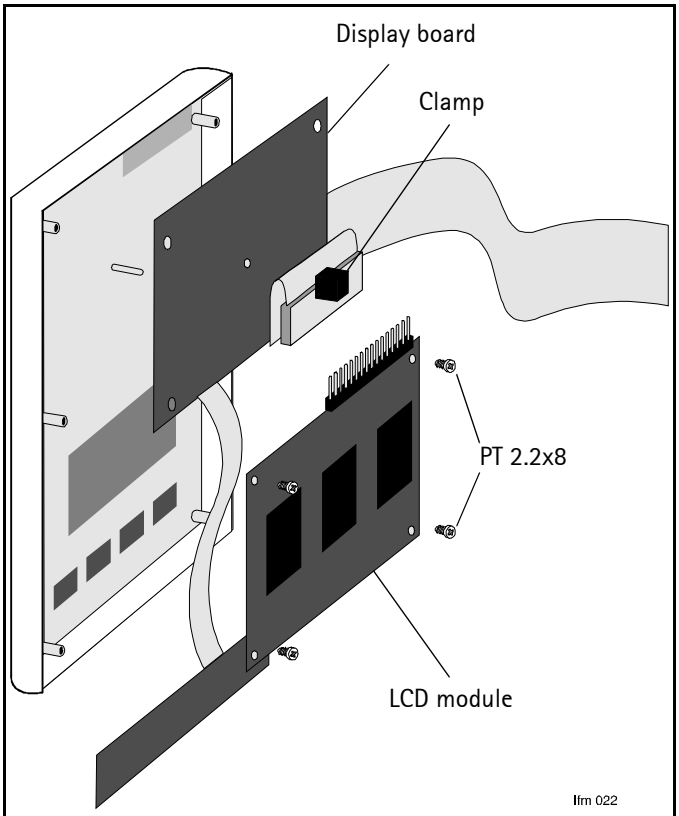


Fig.: 4 - 22

Designation	Ord. No.
Membrane keyboard with support plate, seal and blind plate	3450 5547

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 - 1).
2. Dismount cover (see „Housing“ ➪ p. 4 - 4).
3. Loosen countersunk screw and bridge.
4. Swivel out the microprocessor board.
5. Disconnect flexible cable from the display board.
6. Disassemble pump cover (see „Pump Cover“ ➪ p. 4 - 3).
7. Disassemble front frame (see „Front Frame“ ➪ p. 4 - 15).
8. Disassemble door lock (see „Door Lock“ ➪ p. 4 - 2).
9. Remove tamper-proof caps on the door frame by piercing a screwdriver through the caps.
10. Loosen screws (PT 2.5x14).
11. Remove support plate with modules from the door frame. Carefully pull out the flexible cable through the frame.
12. Remove clamp from the display board.
13. Remove connector from the membrane keyboard and the cable to the LCD module. Remove display board from the support plate.
14. Disassemble the LCD module.
15. Exchange the membrane keyboard with support plate.
16. Assembly is done in reverse order.

Check

Electrical safety, functional check, pump unit check.

4.26 Display Board

Designation **Ord. No.**

Display board, raw material No.: 3810 6205
- Display board new part (Dupont blue) 3450 555A
- Display board exchange (Dupont blue) 3488 046A

Display board, raw material No.: 3810 6906
- Display board new part (AMP black) 3450 555B
- Display board exchange (AMP black) 3488 046B

(see „Microprocessor Board“ ➪ p. 4 – 6)

Clamp for display board (20 pcs.) 3450 0448

Exchange

See membrane keyboard / support plate.

CAUTION

Type of the boards depends on the membrane connectors on the microprocessor board (see „Microprocessor Board“ ➪ p. 4 – 6).

Check

Electrical safety, functional check, pump unit check.

4.27 LCD Module

Designation **Ord. No.**

LCD module 3450 5563

Exchange

1. Remove battery (see „Battery“ ➪ p. 4 – 1).
2. Disassemble door lock (see „Door Lock“ ➪ p. 4 – 2).
3. Remove tamper-proof caps on the door frame by piercing a screwdriver through the caps.
4. Loosen screws (PT 2.5x14).
5. Remove support plate with modules from the door frame.
6. Disassemble the LCD module.
7. Assembly is done in reverse order. Set the contrast.

Check

Electrical safety, functional check.

For your notes:

Checks after Repair 5

Depending on the work carried out, carry out the respective check blocks (1., 2., 3 and / or 4.).

1. Visual Inspection	2. Safety Check according to IEC/EN 60 601-1 or VDE 0751	3. Functional Inspection	4. Pump Unit Inspection
❒ OK after visual inspection	❒ Mains voltage _____ V AC ❒ Protective conductor resistance incl. mains cable < 0.2Ω _____ Ω ❒ Insulation resistance >> 2 MΩ _____ Ω ❒ Earth leakage current ≤30 µA _____ µA ❒ Patient leakage current ≤ 5 µA _____ µA	Switch on unit: ❒ Self-test ❒ Control lamps Compare with display: ❒ Set delivery rate Battery test: ❒ Switch mains/battery/ mains ❒ Switch on in battery mode and check self-test Air inline sensor: ❒ 0.1 ml air bubbles no alarm ❒ 0.4 ml air bubbles alarm ❒ Air value ❒ Water value ❒ Check calibration value and if necessary enter Drop sensor: ❒ Simulate occlusion alarm (alarm with closed roller clamp) ❒ Simulate free flow (alarm) ❒ Staff call ❒ Alarm suppression	Electronic pressure control: ❒ Check alarm with switch-off pressure low / medium / high Mechanical pressure control ❒ max. 1.6 bar _____ bar ❒ > 0.7 bar _____ bar ❒ Safety clamp (no free flow) Pressure check ≥ 0.4bar no free flow ❒ After start-up according to the instructions for use: Delivery accuracy ± 5%

Observe the procedural instructions (see „Procedural Instructions for Inspection“ ➪ p. 8 - 1)!

5 Checks after Repair

For your notes:

Maintenance 6

It is recommended every 2 years. In addition to the technical safety inspection, the following assemblies/components are to be checked:

1. Check rubber feet and if necessary exchange.
2. Check smooth running of the pump cover, lock mechanism and door.
3. Check smooth running of the flow inhibitor, clean and if necessary exchange pressure springs.
4. Check seal membrane and if necessary exchange.
5. Check the drop sensor optics and spring mechanism and clean, if necessary.
6. Open unit. Internal visual inspection. Clean seal surfaces and if necessary exchange sealing strip.
7. Check mechanical pressure control and if necessary calibrate.
8. Check electronic pressure control and if necessary calibrate (see „Pressure Sensor“ ➪ p. 4 – 18).
9. Assemble and seal unit ready for operation.

6 Maintenance

For your notes:

Technical Safety Check TSC

Index c

(Master - to be added to the documentation)

Checklist for Technical Safety Check – Every 24 Months

Unit: Infusomat® fm
Manufacturer: B. Braun Melsungen AG

Observe the Service Manual and the instructions for use. All measured values are to be documented. Accessories used should be included in testing. Make exclusive use of calibrated measuring instruments.

User

Article No.	Unit No.	Year of Procurement

1. Visual Inspection

- ❒ Unit clean, complete, undamaged
- ❒ Pump sealing diaphragm
- ❒ Membrane keyboard, rubber feet
- ❒ Operating unit, lock mechanism, pump cover
- ❒ Safety clamp (flow inhibitor)
- ❒ Mains cable and mains plug connector
- ❒ Staff call lead and plug connector
- ❒ Interface lead and plug connector
- ❒ Drop sensor line and plug connector
- ❒ Check voltage values
  100 -120V T 0.315A
  200 -240V T 0.16A

2. Safety Check

as per EN 60601-1

- ❒ Mains voltage _____ V AC
- ❒ Protective conductor resistance incl. mains cable < 0.2Ω _____ Ω
- ❒ Insulation resistance >> 2 MΩ _____ Ω
- ❒ Earth leakage current ≤30 µA _____ µA
- ❒ Patient leakage current ≤5 µA _____ µA

3. Accessories Used

- ❒ Staff call lead
- ❒ _____
- ❒ _____

4. Functional Inspection

Switch on unit:
- ❒ Self-test
- ❒ Control lamps

Compare with display:
- ❒ Set delivery rate
- ❒ Set volume
- ❒ Set time

Battery test:
- ❒ Switch mains/battery/mains
- ❒ Switch on in battery mode and check self-test

Air inline sensor:
- ❒ 0.1 ml air bubbles no alarm
- ❒ 0.4 ml air bubbles alarm
- ❒ Air value max. 91mV
- ❒ Water value min. 494mV
- ❒ Check threshold value = 182 mV and adjust if necessary

Drop sensor:
- ❒ Simulate occlusion alarm (alarm with closed roller clamp)
- ❒ Simulate free flow (alarm)

Electronic pressure control:
- ❒ Check alarm with switch-off pressure
  low / medium / high

Mechanical pressure control:
- ❒ max. 1.6 bar _____ bar
  > 0.7 bar _____ bar
- ❒ Staff call
- ❒ Alarm suppression
- ❒ Safety clamp (no free flow)
  Pressure check ≥ 0.4bar no free flow
- ❒ After start-up according to the instructions for use:
  Delivery accuracy ± 5%

Infusion line used for Technical Safety Check:
Type: _____ Manufacturer: _____

Test result: Defects found which could endanger patients, users or third parties: ☐ Yes ☐ No

Measures to be taken: ☐ Repair
☐ _____

Special features / Documentation:

Inspection performed by:

Unit handed over to/on:

Date / Signature:

Next deadline:

7 Technical Safety Check TSC

For your notes:

Procedural Instructions for Inspection 8

1. Visual Inspection

Operating unit, lock mechanism, pump cover, seal membrane, flow inhibitor. Door lock: easy opening and closing, correct top and bottom locking.

Pump cover must automatically open when the unit door is opened.

2. Electrical Safety

Protective conductor resistance

Protective conductor resistance < 0.2 Ω incl. mains lead.

Measuring points:

- Potential equalization bolt
- Bolt for door lock
- Unit housing:
  a) If the unit is not sealed countersunk screw at the rear of the unit.
  b) If the unit is sealed, remove lacquer from one of the holes in the foot stands.

Note

Do not use the foot stand mounting screws as alternative measuring points.

Document largest value.

Insulation Resistance

Insulation resistance >> 2 MΩ

Measurement with 500 V between shorted mains connectors and potential equalization bolt.

Earth Leakage Current

Earth leakage current ≤ 30 µA incl. mains cable.

Measurement under standard conditions at the protective conductor of the mains cable. Two measurements (one with reversed polarity). Document largest value.

Patient Leakage Current

Patient leakage current ≤ 5 µA

Connect cannula to the original Infusomat line (medium NaCl solution). Vent the set and run for approx. 1 minute. Measure cannula with test equipment e.g. NSP 3000/4000.

4. Functional Inspection

WARNING

NEVER OPERATE THE UNIT WITH PLUGGED IN SERVICE CONNECTOR ON THE PATIENT. WHEN THE UNIT WAS OPERATED WITH PLUGGED IN SERVICE CONNECTOR IT IS TO BE SWITCHED OFF ONCE BEFORE ANY FURTHER USE.

Switch-on Test

Switch-on test keyboard and display: check correct course. Alarm, LED display 000, LCD display VOL TIME etc. display of all pixels, brightness, contrast.

Battery Test

Switch mains/battery/mains:
Interrupt mains supply twice in intervals of 1 second. Pay attention to the switch-over on the LED display. The unit must not switch to malfunction.

Note

Running time minimum 30 minutes after charging of 16 hours.

Air Inline Sensor

Set rate to 400 ml/h.

- Inject 0.1 ml air bubble with a 1 ml syringe. An alarm must not be activated.
- Then inject 0.4 ml air bubble. An alarm must be activated.
- Check air inline sensor values in the Service Program "Air Inline Sensor Function 300.0", (see „Air Inline Sensor Function 300“ ➪ p. 3 - 6) and „... 520.0“ (see „Air Inline Sensor Function 510* or 520**“ ➪ p. 3 - 11). Values see TSC-list (see „Technical Safety Check TSC“ ➪ p. 7 - 1).

Drop Sensor

Set rate to 400 ml/h.

- Simulate occlusion: Clamp infusion line in front of pump to prevent any drops. Alarm after less than 5 sec.
- Simulate free flow: Press bottom part of the drop chamber together, to generate a jet. Immediate alarm.

Staff Call

Operation: Pin 3 and 5 connected. Pin 1 and 3 open.
Alarm: Pin 1 and 3 connected. Pin 3 and 5 open.

Note

Reverse connection with IFMA software.

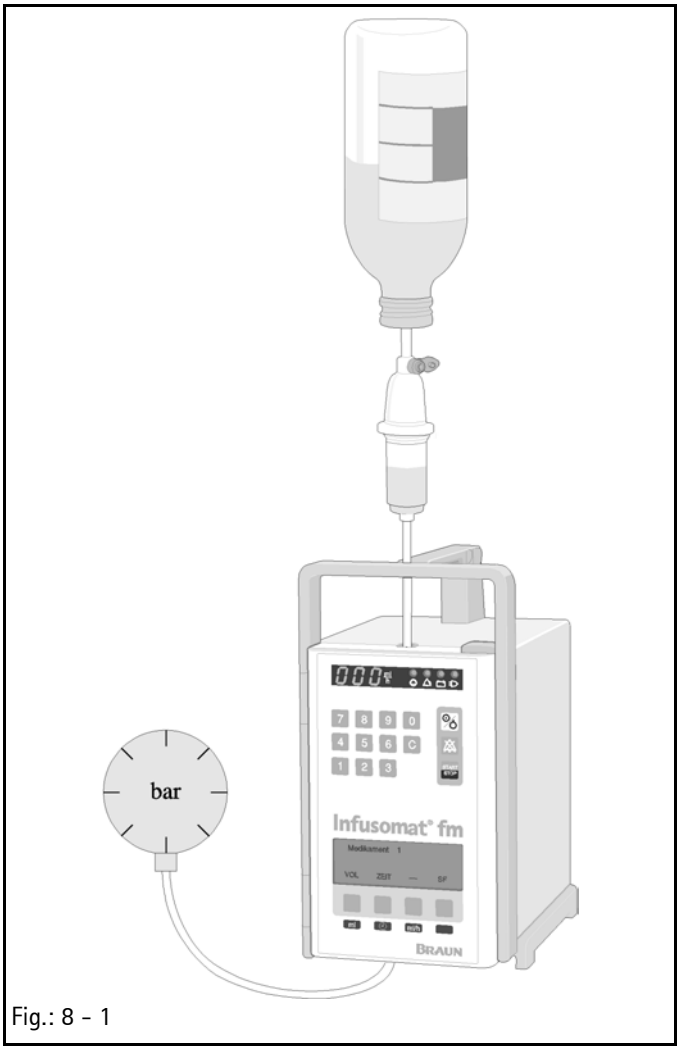


Fig.: 8 - 1

Alarm Suppression

Press the alarm key. The current alarm is suppressed for 2 minutes.

General Pressure Measurement

An electronic manometer should be used for the measurement described hereafter.

If a mechanic manometer is used instead values which are appr. 100 mbar lower are to be expected.

Connect manometer to the outlet side of the pump and position the manometer approx. to medium height of the Infusomat® fm. Proceed as follows:

- Vent manometer (filled with water) ϕ100 mm or 160 mm.
- Measuring range: 2.5 or 4 bar.

Note

The results differ according to different measuring methods.

Use infusion line maximum 50 times for pressure measurement.

Electronic Pressure Control (Pressure Sensor)

Set rate to 50 ml/h. Pressure sensor threshold low/medium/high.

Deliver in an open system via the 3 way stop-cock. Turn stop-cock to manometer and build-up pressure.

Document the alarm threshold.

Pressure sensor threshold low	250 to 650 mbar
Pressure sensor threshold medium	550 to 950 mbar
Pressure sensor threshold high	900 to 1300 mbar

Mechanical Pressure Control

- Set pressure sensor threshold to mechanical (test plug).
- Switch off drop control. Build up pressure with 400 ml/h. Then measure with 100 ml/h.

Measurement upper pressure value	1.35 to 1.76 bar (mechanical measurement, max. 1.6 bar)
Measurement lower pressure value	> 0.95 bar (mechanical measurement > 0.7 bar)

Mechanical Pressure Calibration

Check pump pressure. If the deviation is max. ± 0.3 bar from set range, the pump can be recalibrated.

P_{max} 1.35 to 1.76 bar; P_{min} > 0.95 bar.

Carry out pressure measurement. Calibrate pressure range at the set screw with an Allen key 2.5 mm. - After the pressure check the mechanical setting is to be switched off!

After the service connector has been disconnected the electronic pressure control is not automatically activated again.

Flow Inhibitor

Switch to stop at high pressures. Then open unit door. The pressure must stay above 0.4 bar.

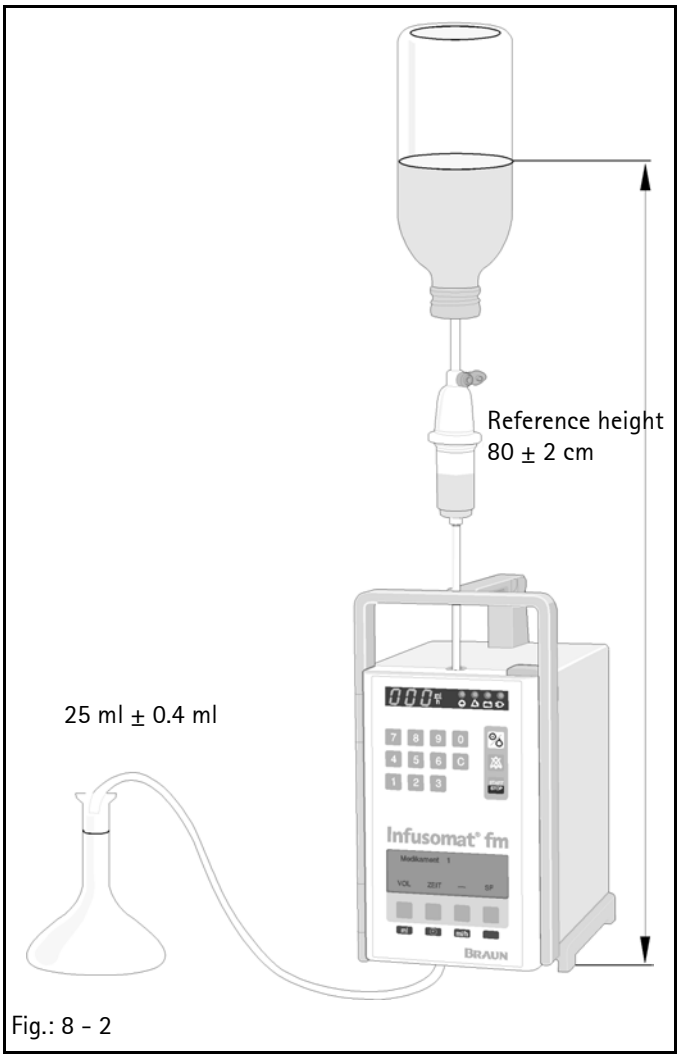


Fig.: 8 - 2

Delivery Accuracy

Measuring equipment:

- 500 ml glass bottle, vented, drop chamber filled 2/3.
- Graduated cylinder 25 ml, accuracy ± 0.4 ml
- Infusion solution NaCl or distilled water .
- Check system: no narrow sections or kinks. Delivery rate 250 ml/h. Run-in time minimum 1 minute.

Delivery rate determination:

- Perform measurement at ambient room temperature.
- Insert outlet cannula in graduated cylinder. Simultaneously start stop watch and Infusomat fm. Stop when the 25 ml mark is reached. A deviation of 3.6 ml is equivalent to approx. 1 % in the relevant range. Example:

Set rate: . . . . . 250 ml/h

Measured volume: . . . . . 25 ml

Measurement Time		Deviation %	Rate ml/h
6 min	40.0 sec	-10	225,0
6 min	18.9 sec	-5	237,5
6 min	15.0 sec	-4	240,0
6 min	11.1 sec	-3	242,5
6 min	7.3 sec	-2	245,0
6 min	3.6 sec	-1	247,5
6 min	0.0 sec	0	250,0
5 min	56.4 sec	1	252,5
5 min	52.9 sec	2	255,0
5 min	49.5 sec	3	257,5
5 min	46.2 sec	4	260,0
5 min	42.9 sec	5	262,5
5 min	27.3 sec	10	275,0

Table 8 - 1

The inspection can be performed with a standard infusion line.

A calibration line must be used for calibration! (see „Test Equipment and Special Tools“ ➪ p. 9 - 1)

Alternative Measuring Methods

Inspection of the delivery rate with a weight measurement. Avoid errors due to evaporation!

Measuring equipment:

- Scales

Accuracy 0.1 g:	12 min
Accuracy 0.01 g:	6-12 min

Delivery rate determination:

- Set the delivery rate to 200 ml/h and run unit ≥ 60 sec. (run-in time).
- Insert the outlet cannula in container and simultaneously start stop watch and Infusomat fm.
- After the time has expired stop Infusomat® fm and stop watch.
- Immediately determine the delivery rate.

Test Equipment and Special Tools 9

Test Equipment and Special Tools

For Repair / for Technical Safety Check (TSC)

	Order No.
Test equipment case Infusomat fm (complete)	0770 1527
with:	
Calibration gauge 4 mm (for adjustment after exchange of the pump cover)	0770 1489
Pin punch 1.8 mm x 160 mm (for hinge pin/ disassembly of the pump cover)	0770 1446
Pin punch 6 mm x 125 mm (for hinge pin/ assembly of the pump cover)	0770 1454
Flat tool 100 x 20 mm (for assembly/ disassembly of the tube adapter)	0770 1462
Special socket spanner M18 (for disassembly of the recessed plug)	0770 1497
Manometer 0 - 4 bar	0770 1357
Service connector (red)	0770 0709
MFC service connector	3450 1215
OIL-test infusion line	0770 1500
Pressure calibration device	0770 5018

9 Test Equipment and Special Tools

For your notes:

Spare Parts List 10

Unit Elements

Designation	Ord. No.
Fuse T 0.16 A for 200-240 V (10 pcs.)	3477 2847
Fuse T 0.315 A for 100-120 V (10 pieces)	3477 0534
Fuse holder	3450 5652
Battery incl. connector plug, 1.8 Ah / 7.2 V.	3450 6357
Cover for battery compartment	3450 5504
Door lock complete with push button	3450 5601
Spring holder for door lock	3450 5440
Fixture for door lock	3477 2790
Housing labelling	
German	3450 5610
French	3450 5946
Dutch	3450 5954
Italian	3450 5962
English	3450 5970
Spanish	3450 5989
Danish	3450 5997
Norwegian	3450 6101
Swedish	3450 6110
Finnish	3450 6128
Portuguese	3450 6136
Czech	3450 6144
Polish	3450 6152
Castellano	3450 6160
Turkish	3450 6179
Foot stand complete with rubber feet	3450 5415
Handle.	3450 5512
O-ring (20 pcs.)	3477 1530
Analog board new part	3450 580B
Analog board exchange.	34 88 047B
Fuse T 1.6 A on analog board (10 pieces)	34 77 3312
Rear panel without accessories	3450 5628
Cover for optical interface	3477 3164
Strip seal for rear panel.	3477 3142
Drop sensor socket incl. cable and plug	3450 5687

Designation	Ord. No.
DIANET recessed plug (8 pin)	3450 5679
Staff call recessed plug (5 pin)	3450 5660
Rear panel board with 5 and 8 pin recessed plugs	
with 5V TTL interface	3450 5636
with RS232 interface	3450 563A
fm recessed plug (3 pin)	3477 3177
Potential equalization bolt	3477 0550
Recessed mains plug without fuse holder	3450 5644
Fuse holder	3450 5652
Mains transformer 200-240 V	3450 5709
Mains transformer 100-120 V.	3450 5695
Pump cover with lock	3450 5717
Blind plug 7.1 mm (10 pcs.)	3477 3207
Torsion spring in lever / pump cover (5 pcs.)	3477 3363
Torsion spring for pump cover (5 pcs.)	3477 3355
Lever (pump cover).	3477 4092
Hinge pin for pump cover	3477 3967
Hinge pin for pump cover lever.	3450 5725
Reed sensor set	
Sensor incl. 8 pin socket plug	3450 5814
Reed sensor incl. crimp terminals	3450 5431
Socket plug (AMP/100 pin)	3451 3744
Front frame without flow inhibitor and pressure spring	3450 5822
Circular seal behind front frame	3477 3126
Flow inhibitor with pressure spring	3477 3258
Pressure spring for flow inhibitor (5 pcs.)	3477 3266
Tube adapter with magnet	3450 5830
Magnet for tube adapter	3450 5849
Finger pump (without motor) including pump, pump cover, seal membrane and boards	3450 5407
Finger pump (without motor) including pump, pump cover, and seal membrane	3450 5407
Membrane for pump unit	3450 5733
Motor with pinion	3450 5741

Spare Parts List

Designation	Ord. No.
Pressure sensor (cmpl.)	3450 7345
Air inline sensor with crimp terminals	3450 5750
Buzzer incl. seal ring	3450 5776
Air insulation board	3450 6187
Frame unit with seal plate	3450 5466
Door frame incl. pressure spring and magnet without door lock	3450 5598
Seal for door frame / flexible cable (5 pcs.)	3477 3347
Hinge unit	3450 5571
Hinge pin for hinge unit	3450 5580
Membrane keyboard with support plate, seal and blind plate	3450 5547
Display board, raw material No.: 3810 6205	
Display board new part (Dupont blue)	3450 555A
Display board exchange (Dupont blue)	3488 046A
Display board, raw material No.: 3810 6906	
Display board new part (AMP black)	3450 555B
Display board exchange (AMP black)	3488 046B
Clamp for display board (20 pcs.)	3450 0448
LCD module	3450 5563

Software Update

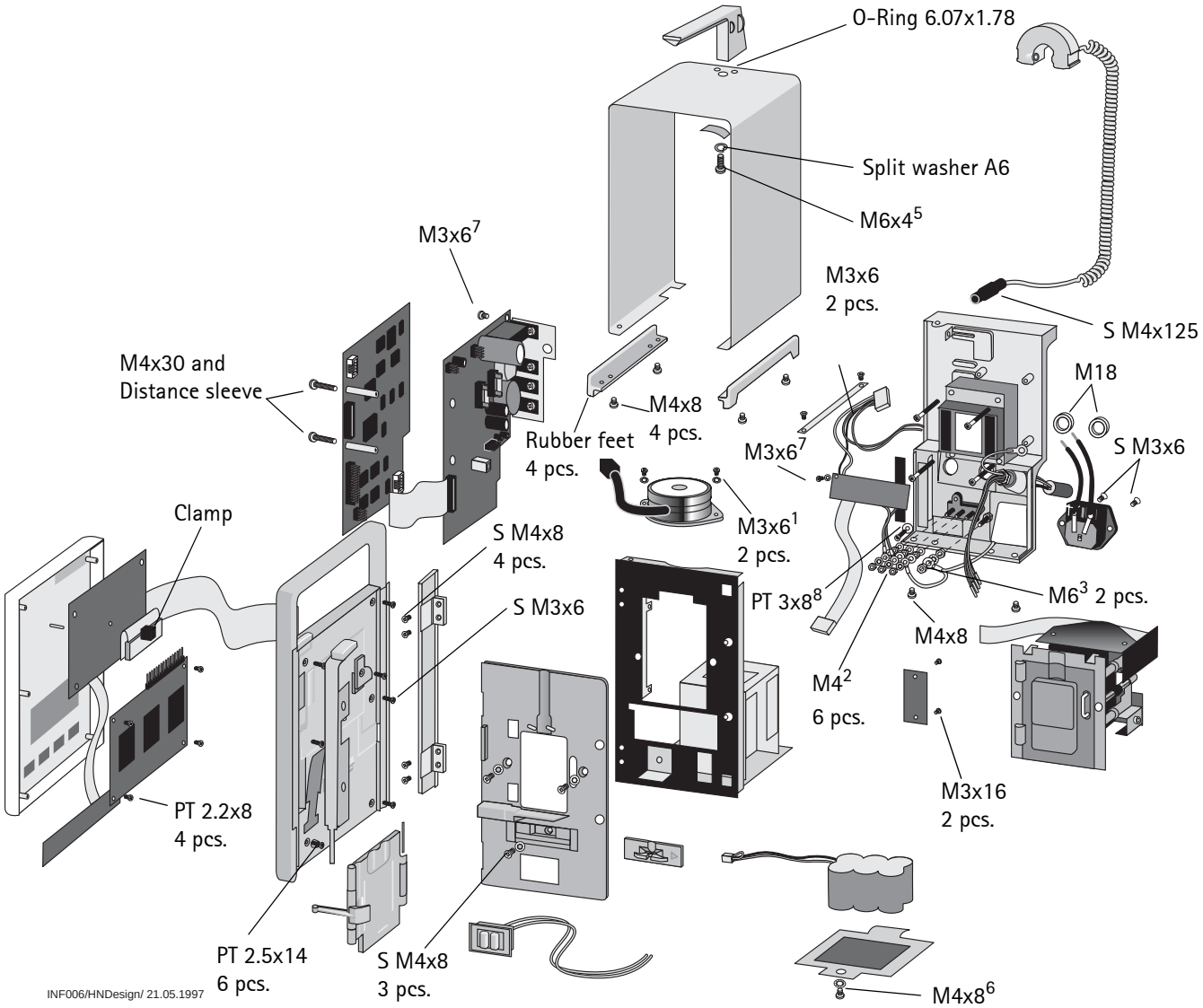
Update kit IFMB00002 or IFMB01002	3450 6306
Interface line	0871 1658

(see „Computer Interface“ ➪ p. 1 – 9)

Colours

Touch-up pen RAL 9002 (white)	3450 6977
Touch-up pen RAL 7031 (grey)	3450 6985

Designation	Ord. No.
Miscellaneous	
Mounting screw PT 2.5x14 (10 pcs.)	3477 3100
Mounting screw PT 2.2x8 (10 pcs.)	3477 3118
Screw PT 3x8 (20 pcs.)	3477 3185
Screw M 4x30	Standard part
Screw M 3x6	Standard part
Screw M 4x8	Standard part
Screw M 6x45	Standard part
Screw M 3x30	Standard part
Screw M 3x16	Standard part
Screw M 4x12	Standard part
O-ring 6.07x1.78	3477 1530
Distance sleeve (10 pcs.)	3477 3231
Plain washer 3.2 (20 pcs.)	3477 3193
Split washer B 3.1	Standard part
Washer 4.3	Standard part
Washer 6.4	Standard part
Serrated lock washer I 6.4	Standard part
Serrated lock washer I 3.2	Standard part
Serrated lock washer V 4.3	Standard part
Rubber feet (20 pcs.)	3477 3096
Tamper-proof cap 10mm (50 pcs.)	3477 3134
Label for fuse (5 pcs.)	3477 3150
Clamp for display board (20 pcs.)	3450 0448
Shrink tube size 48	Standard part
Shrink tube size 32	Standard part



[1] in addition split washer B 3.1

[2] in addition washer 4.3 and serrated lock washer I 4.3

[3] in addition washer 6.4 and serrated lock washer I 6.4

[4] in addition serrated lock washer I 3.2

[5] in addition serrated lock washer V 4.3 and tamper-proof cap 10 mm

[6] in addition serrated lock washer I 4.3

[7] in addition serrated lock washer I 3.2

[8] in addition washer 3.2/9

S=Countersunk screw

Fig.: 10 - 1 Exploded drawing

Accessories

Designation **Ord. No.**

Pole Clamp

Pole clamp (universal clamp, rotating) 3450 9054

Universal Clamp (Pole Clamp)

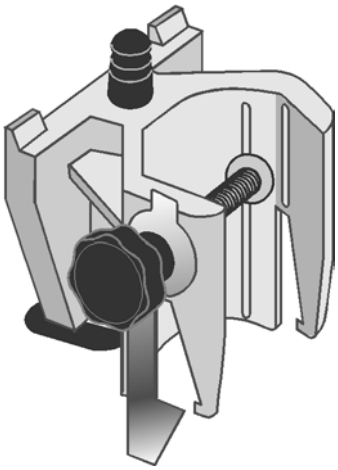


Fig.: 10 - 2 Universal clamp (Pole clamp)

Designation **Ord. No.**

Universal clamp, complete 3450 5857
Universal clamp 3450 8325
Threaded rod. 3450 8333
Star handle body 3450 8384
Safety clip. 3450 8341
Safety hook. 3450 8368
Plate (2 pcs.) 3450 2610
Connection cap D12/4 (5 pcs.) 3477 4149
Bellows (5 pcs.) 3477 3274
Pressure spring (5 pcs.) 3477 4165

Designation **Ord. No.**

Universal Clamp

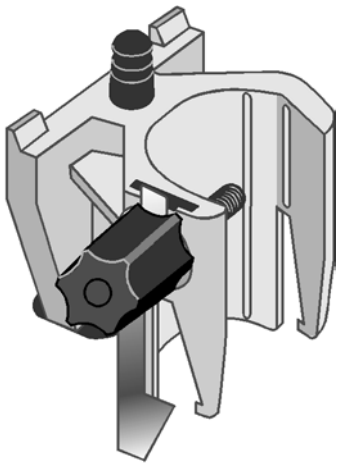


Fig.: 10 - 3 Universal clamp

Designation **Ord. No.**

Universal clamp, complete. . . . . not available any more
Threaded rod 34 50 5903
Safety hook. 34 50 5865
Turning handle 34 50 5890
Rubber cover (5 pcs.) 34 77 3290
Bellows (5 pcs.) 34 77 3274
Connection cap (5 pcs.) 34 77 3304
Pressure spring for pole fixation (5 pcs.) 34 77 3282

Appendix

A

Revision Service Documentation

Version 2.0

This manual has been completely revised. The most important changes are listed below:

- Changed manual structure
- New air value
- New TSC list
- New paragraph pressure sensor (exchange / calibration)
- New test equipment for pressure sensor
- New spare parts
- Total list of spare parts

Version 2.1

- Changed spare parts numbers

Version 2.2

This version was approved by B.Braun on 26.09.2006.

The most important changes of this version are listed below:

- Changed pressure sensor values
- Changes in texts and layout

Current Information

1. Noise Reduction

From unit number 31067 the running noise of the motor was reduced by optimizing the motor drive. This modification is standard for analog boards from index D on.

Retrofitting for old boards:

Designation	**Ord. No.**
Retrofit kit for noise reduction	3450 0952

Note

See assembly instructions for retrofitting.

2. EMC: Increase of Interference (e.g. against mobile phones)

Exchange drop sensor against shielded version.

Identification of a shielded drop sensor:

The sensor is either marked with a casting stamp or an index A.

Check: Ground contact of the drop sensor socket, if necessary retrofit (see „Drop Sensor Socket“ ➪ p. 4 – 10).

If the drop sensor is not shielded:

Retrofit interference clips

Designation	Ord. No.
Retrofit kit.	3450 6969

Note

See assembly instructions for retrofitting.

3. Modification of the Interface from 5V TTL to RS232

- Connect pin 3B of connector P5 on the soldering side to +5V (IR receiver V4, pin 3).
- Document the modification of the board by the following index:

  MP old without index ➪ new index D,
  MP old index A ➪ new index E,
  MP old index B ➪ new index F.

  Mark the RS232 interface on the unit rear panel with an RS232 sticker.

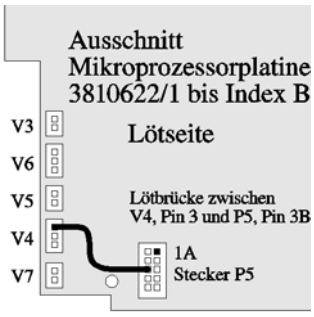


Fig.: 1 - 1